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Our readers are requested to note that the date of publication has been changed to the first Thursday in the month. This means that the paper will be mailed on the preceding Wednesday night and that it should be delivered to cities near the office of publication on the next day. However, because of the action recently taken by the post office department whereby the papers are carried over certain districts by freight instead of entirely by fast mail, as formerly, some delay in the delivery of the paper is to be expected by those subscribers at a distance from New York. If too great a period occurs between the time of publication and the delivery of the paper we would suggest that you take the matter up with your postmaster, and also notify this office.

More Information on Blue Prints

It has been suggested that the standard practice, particularly in the case of wear limits, be placed in clear language on the blue print of the part affected, so that this information would be available to the workman. This is an excellent suggestion, and while men who are steadily engaged on the same job generally carry such information in their heads, there is no reason why it should not be on the blue print and thus avoid the danger of any misunderstanding or mistake. It would relieve the foreman of considerable trouble in many cases, and would frequently prevent useless machine work. This practice would be particularly applicable to the wear limits for axles, crank pins, piston rods, cylinder bores, piston head clearances and driving wheel tire thickness.

Finishing Driving Boxes

The competition on the best method of finishing driving boxes closes on May 1. A prize of $25 will be awarded for the method that is judged to be the best. This is one of the most important jobs in the shop, and one to which many shop superintendents have given careful study. In awarding the prize full consideration will be given to any unusual handicaps, if you make them clear in your description. Simply furnish a statement of facts giving detailed particulars for each step of the work, blue prints or photographs of any special tools or equipment used, and a record of the time required for each part of the work. There is still plenty of time for you to prepare the matter before the closing date, if you start to work on it at once. A more extended announcement of the contest will be found in our March issue.

Beech Grove Car Repair Shops

The second stage toward the completion, as originally planned, of the repair shops of the Big Four at Beech Grove, Ind., was marked by the recent transfer of all coach repairs to that point. The next step will be the erection of freight car repair shops and of the locomotive terminal, which will take place when the large classification yards to be located here are installed. The new coach shop at Beech Grove provides practically perfect facilities for repairs to this class of equipment. The manner in which crane service is provided to meet all reasonable requirements, but without extravagance either in the equipment or structure, is particularly interesting. Cranes are available for lifting car bodies, handling and transporting trucks, large sills, wheels, underframe castings, and in fact all heavy parts, and still they serve less than half the floor area of the building. A study of the whole plant develops but one possible point of criticism, and that is in the placing of the cabinet shop on the second floor of the planing mill, which necessitated extremely heavy steel work in the roof trusses to give a clear floor area on the first floor. It would hardly seem that the advantages of having the cabinet shop in this location were sufficient to justify this expense, particularly at a point where there is

little restriction imposed by the value of the land. To be sure the present arrangement is very satisfactory, but the disadvantages of having this shop as an extension either on the planing mill or coach shop would hardly seem great enough to warrant this expense. The facilities provided for repairs to tenders in the new tank, cab and pilot shop are probably not surpassed at any point in the country and a building of this kind would undoubtedly prove a source of economy at many other shops. The same thing also applies to the wheel shop, which is so located as to give storage room on all sides and direct transportation to and from each to any desired point about the shops.

Treated Lumber for Cars

Decay is an important factor in the life of the underframe, floors and posts on certain classes of wooden freight equipment, particularly stock cars. While timbers treated with a preservative have occasionally been used in small amounts in car construction, the Chicago, Burlington & Quincy is the first company to go into the matter extensively, and is now using the creosote zinc chloride or "Card" process for the sills and flooring of a thousand stock cars being built at its Aurora, Ill., shops. The sills are of Oregon fir, and the floors of Norway pine, and it is stated that the cost of treating the lumber for one car is but $7. The treating is being done at the tie treating plant at Galesburg, Ill. The disadvantages of the treated lumber to the workmen are overcome by the use of mittens when handling it, and by goggles to protect the eyes when nailing. It would seem that the same process would also be applicable to certain classes of gondola cars, and while the creosote method could not be used for box or refrigerator cars, it is possible that some other preservative that would not affect the lading could be found which could be applied to the timber for such cars.

All-Steel Box Cars

All-steel box cars have been considered for several years, and two or three experimental cars of this type have been built. It has remained for the Bessemer & Lake Erie to take the first important step in introducing such equipment, and that road has recently ordered 100 of these cars, similar to a sample car which was constructed a couple of years ago by the Summers Steel Car Company of Pittsburgh, Pa. The sample car has given very good satisfaction, and no difficulty has been encountered because of moisture condensing on the inside of the car and damaging the lading. In one instance a consignment of tin plate was carried from Pittsburgh to the Pacific coast during the spring season without any damage to it; in fact, it is said to have been received in better condition than similar consignments which were carried in wooden cars. These cars will undoubtedly have higher temperatures inside during the hot weather than the wooden cars. There is a question, however, as to whether the heat will be great enough to cause any damage, and if it does, means will undoubtedly be found for using some sort of insulation on the inside of the roof and sides of the car above the wooden lining. It is estimated that at the present prices of wood and steel the all-steel car can be built in competition with the wooden one, either with or without a steel underframe, and if the price of lumber should increase at a faster rate than that of steel, and it undoubtedly will, it is quite possible that it will prove economical to introduce such cars extensively.

Probably the most difficult problem in connection with the introduction of these cars will be to provide a truck of sufficient flexibility and so designed that the weight on it will be equally distributed on all four wheels at all times. A rigid car body placed on the ordinary type of freight car truck is liable to cause considerable expense and inconvenience due to derailments. Realizing this, and that the steel box car will not prove a success with the ordinary truck, Mr. Summers has developed a special truck which is deserving of the most careful consideration. New refrigerator cars, which have a far more rigid construction than box cars, frequently give trouble from derailments, and undoubtedly this could be largely overcome by the application of a truck such as Mr. Summers proposes to use under the steel box cars.

Brake Shoe Tests

An extensive series of tests has been made during the past year by the Brooklyn Rapid Transit System to determine what type of brake shoe would give the best results on its cars. The conditions of service on this road differ so radically from those on steam roads that the conclusions from the tests do not apply to the latter. Nevertheless several important features were developed which are worthy of consideration by the steam railway men. For instance, it was demonstrated that the harder the brake shoe the longer its life and the lower its co-efficient of friction. The softer shoes, however, did not wear the wheels nearly so much, so that taking into consideration both the brake shoe wear and the wheel wear it was a question which shoe it was best to use. If the brake shoes are purchased on the basis of a fixed price per 1,000 car miles it would be possible to pay between 15 and 20 cents more per 1,000 car miles for the plain cast iron shoe than for the one with the chilled ends. George L. Fowler, who was in charge of the tests, stated in his report that the ideal scrap weight of the surface car shoes should be about 30 per cent. of the weight when new and 25 per cent. for the shoes used on the elevated railway cars. This condition is possible of attainment where the foundation rigging is in good condition and the shoes are of a uniform texture, but if the head of the shoe is tilted so that the scrap shoe is thicker at one end than the other, the additional metal which it is necessary to scrap amounts to from 10 to 20 per cent. of the weight of the shoes when new, thus adding a corresponding amount to the cost of the shoe.

Service Results of Locomotive No. 50,000

Number 50,000, the experimental Pacific type locomotive built by the American Locomotive Company to determine the limits to which the efficiency and capacity of a pasesnger locomotive of standard wheel arrangement could be developed, has been in use on the New York and Delaware divisions of the Erie during the past winter. Between November 17, 1911, and February 25, 1912, a period that included the most severe weather conditions, this engine made 170 runs with trains that averaged nine cars, and frequently had eleven or twelve cars. During this time it made schedule speed or better on 163, or 96 per cent. of the trips. The railway company's performance sheets show that the locomotive made up 1,379 minutes, or an average of 8 minutes per trip, and on the 7 trips when it lost time there were contributory causes for delays for which the locomotive could not be held responsible. There are long heavy grades in both directions on these divisions and sharp curves are numerous. The schedule speed of trains No. 5 and 6, to which No. 50,000 was assigned, is 35 miles per hour, including frequent stops, and there is a rigidly enforced rule limiting the maximum speed to 60 miles per hour. The capacity of the locomotive is possibly best illustrated by the service during the coldest days in January, from the 5th to 8th, when in 8 runs it made up a total of 120 minutes, or an average of 15 minutes per trip in a distance of 193 miles with 9-car trains. While there is nothing particularly spectacular about this performance, it clearly indicates the value of surplus power. Any locomotive that can make up 15 minutes per trip with a 9-car train during the coldest day of last winter is a big asset to the company owning it. A fully illustrated description of No. 50,000 appeared on page 5 of the January issue of the *American Engineer*.

Safety Competition

Railways and industrial organizations have awakened to the necessity of giving more attention to the safety and welfare of their employees. Several roads have adopted the slogan of "safety first," and considerable attention has been given to safeguarding the machines in the shops and of taking measures for the prevention of accidents in engine houses and car repair yards. A prize of $25 will be awarded for the best article on the subject which is received before June 1. The article may consist either of detailed descriptions of a device or devices which have been provided for safeguarding tools and protecting the workmen, or of methods which have been used or may be used to awaken the employees to a realization of their part in the campaign. This competition has been suggested by one of our readers, and the following is an extract from his letter and may suggest methods of treating the subject which may appeal to some of our readers. "Another interesting competition could be conducted on safety appliances in railway shops, guards around machines—showing how they are made and applied. Or guards under high speed belts to prevent the workmen being hurt when they break. The best system of periodical inspection of safety appliances and machinery, or descriptions of any device or appliance that is used in any way to prevent or eliminate accidents to employees might be considered. Manufacturers of machinery are now compelled to put guards over all gears, as far as possible, and such guards should not be considered in the competition. What we want to know about is the home made guards and protections." Articles which are not awarded the prize, but which are accepted for publication, will be paid for at our regular space rates.

Electrification of Steam Roads

The problem of electrifying steam roads was given considerable attention during March, it being the subject of a paper by William J. Clark, of the General Electric Company, before the Franklin Institute of Philadelphia, as well as the subject for discussion at the New York Railroad Club meeting. The most important point developed by Mr. Clark was that the problem of handling traffic over heavy grades or mountainous districts might be solved far more advantageously by electrifying such divisions, rather than by going to heavy expense in eliminating the grades, or by introducing extremely heavy and powerful motive power. An instance was cited of a proposed western railway, about 160 miles long, located in a mountainous district. The surveys were made, one for grades which would permit of steam operation, and another for grades which could easily and economically be operated by electricity. The engineers estimated a saving in favor of electricity on 6½ miles of the proposed line which would more than cover the expense of electrifying the entire 160 miles. They also estimated that the expense of operating by electricity would be less than for operating by steam.

The New York Railroad Club meeting was what is known as the annual electrical night. The most important feature of the meeting was that the electrical engineers, now that they have had several years experience with electrification, are not quite so sure that it can be universally applied to steam railways as they were a few years ago. There is no question but what electrification is a desirable feature under many conditions, but the great first cost of electrifying will stand in the way of its being adopted, particularly where there is any question as to the possibility of sufficient new business being developed to off-set the additional financial burden which will be imposed.

George Gibbs, electrical engineer of the Pennsylvania Railroad, gave some date concerning the first year's electrical operation of the Pennsylvania at the New York terminal. The main line from Harrison to the terminal station is about nine miles long. Of this 6½ miles are on the level and the rest of the line through the tunnels and its approaches has some very heavy grades. The service is largely handled by electric locomotives. The tunnel is much drier than was anticipated, and there is therefore a better factor of adhesion. The locomotives have made a total of 909,000 miles during the year, of which 650,000 miles was road service, while the remainder was for switching and transfer. The locomotives averaged 26,000 miles for the year, and the service was entirely satisfactory. The cost of repairs per mile run was 5.91 cents. This is greater than was expected and was largely due to the cost of maintenance of the brake shoes, to tire turning, and to a number of structural changes which it was necessary to make after the locomotives were placed in service. On the New Jersey division the cost of repairs to steam locomotives was 8.83 cents per mile, while for the Pennsylvania as a whole the cost was 11.91 cents per mile. The lubrication of electrical locomotives cost .25 cents per mile, or about the same as for the steam locomotives. The engine house expense for the electric locomotives amounted to .58 cents per mile, while for steam locomotives on the Pennsylvania it amounted to 2.58 cents per mile. The important savings were, therefore, in the repairs and the engine house expenses. The electric locomotives are given a daily inspction and after every 2,500 miles run are given a detail inspection which requires about four hours' time. When the electrical operation was first started the locomotives were given a detail inspection after every 800 miles, but this has been gradually increased to 2,500, as the reliability of these locomotives has become more evident. There were only 16 failures of electric locomotives during the year, and for the multiple unit trains, which made about 300,000 miles, there were only three detentions.

NEW BOOKS

Proceedings of the Forty-Fifth Annual Convention of the Master Car Builders' Association, held at Atlantic City, N. J., June, 1911. 800 pages. Cloth. Published by the association, J. W. Taylor, secretary, 390 Old Colony building, Chicago. Price, $7.50.

Beyond doubt there is no association in the mechanical department of railways whose work has as far reaching and important effect as the Master Car Builders' Association. Each convention makes distinct progress in some important particular, as well as many improvements in minor affairs. Probably the most important work done at the last convention was in connection with the new design of coupler and of the action on safety appliances. This volume contains the full account of the reports and discussions, as well as the standards of the association, list of members, committees to report in 1912, constitution, by-laws, etc.

The Signal Dictionary, Second Edition. Revised by A. D. Cloud, editor of the *Signal Engineer*, and H. H. Simmons, associate editor, *Railway Age Gazette*. 9 in. x 12 in. 566 pages; 3,899 illustrations. Published by the *Railway Age Gazette*. Distributed by the McGraw-Hill Publishing Company, New York. Price, leather, $6; cloth, $3.50.

The Railway Signal Association Signal Dictionary, first published in 1908, has been revised and published in the second edition under the supervision of a committee of the association. The aim in revising the book, as stated in the preface, has been to "retain descriptions and illustrations of apparatus which, although no longer made, is and will remain for some time in rather extensive use, as well as to reflect the latest work of the manufacturers." That the book is not merely a catalog of manufacturers' devices is shown, however, by the fact that it contains practically all of the standards of the Railway Signal Association and a great many standards adopted by the signal departments of prominent railways of this country and England. Another change which will be found almost as valuable as the addition of up-to-date apparatus and standards is the rearrangement of the material in a form which is intended for ready reference. The definition section, or dictionary proper, was amplified considerably with special attention to the terms used in connection with alternating current apparatus, and the whole sec-

tion was revised and brought up to date. All definitions which can be illustrated by the figures in the descriptive part of the book are referred to by their figure numbers. The descriptive part of the book is divided into five sections, which are clearly marked by title pages and subdivided to arrange each branch of the subject under distinct headings, and a complete cross reference index is added. The divisions of the descriptive part are: Signal symbols and signal indications; block signaling; interlocking; highway crossing signals, and accessories. The last-named division contains 18 subdivisions, in which the apparatus and devices used in railway signaling are illustrated and described.

Proceedings of the Forty-Fourth Annual Convention of the American Railway Master Mechanics' Association, held at Atlantic City, N. J., June, 1911. 516 pages. Cloth. Published by the association, J. W. Taylor, secretary, 390 Old Colony building, Chicago. Price, $2.50.

Reports and papers on the following subjects presented at the last convention are given in full in this volume: Mechanical stokers; smoker consuming devices for terminals; construction of locomotive frames; main and side rods; formulae for designing piston rods and crossheads; equipment for engine houses; best method of treating feed water when water treating plants are not practicable; lubrication of locomotive cylinders; locomotive performances under different degrees of superheated steam; safety appliances; design, construction and inspection of locomotive boilers; contour of tires; flange lubrication and standards. Full specifications and drawings of the standards of the association are included in the volume; also the list of members and their addresses, the committees and subjects for the next meeting, and the constitution and by-laws of the association.

Proceedings of the Nineteenth Annual Convention of the Traveling Engineers' Association, held at Chicago, August 29-September 1. 495 pages. Flexible covers. Published by the association, W. O. Thompson, secretary, Buffalo, N. Y. Price, $1.50.

In the selection of subjects and the character of the discussion the members of this association indicate that they propose to obtain all the real benefit possible from the time spent at the conventions. More real valuable information will be found in these proceedings on the subjects discussed, expressed clearly and frankly, than is available from any other source. Reports and papers on the following subjects were presented: Actual demonstration vs. oral instruction in air brake operation; value of practical instruction on fuel economy; lubrication of high pressure and superheater locomotives; efficient handling of the electric locomotive; development and improvement in automatic stokers; Mallet compound locomotives in road service; benefit from chemically treated feed water, and benefits derived from the use of the brick arch. The volume contains a list of the subjects which have been discussed at each of the annual conventions of the association since 1893. There is also a list of the subjects which will be brought up at the next annual meeting.

Forney's Catechism of the Locomotive. Third Edition, Revised and Enlarged. Part I. By George L. Fowler, associate editor *Railway Age Gazette.* 6 in. x 9 in.; 644 pages; 475 illustrations. Bound in cloth. Published by the Simmons-Boardman Publishing Company. Distributed by the McGraw-Hill Book Company, 239 W. 39th street, New York. Price, $3.

The Cathechism of the Locomotive, by M. N. Forney, was probably the best known and most widely studied book on the subject that has ever been published. The first edition was issued in 1873. It was afterwards revised by Mr. Forney, and the second edition was published in 1889. Since that time the methods of locomotive design, construction and operation have been revolutionized and a third revised edition became necessary in order that the book might adequately describe the locomotive of today. The preparation of the third edition of the book was intrusted to George L. Fowler, who for many years had been an intimate friend of Mr. Forney and who had been asked by the latter to undertake the work.

The growth of the locomotive in size and the complexity of its details during the past twenty years necessitated the introduction of a great deal of new matter, and the discarding of a little that was old. The years intervening between the appearance of the second and this third edition, have witnessed the rise and partial decadence of the compound locomotive; the birth of the Mallet; the introduction of the superheater; the development of the Atlantic and allied types where the wide firebox is carried by a trailing truck, the use of oil as a fuel; the application of the Walschaert valve gear to American locomotives; the rise of the stoker and the improvements of the air brake, as well as the growth of innumerable details that go for efficiency, to which must be added the great increase in the size and weight of the locomotives of today, as compared with those of two decades ago.

Each of these themes is treated fully, clearly and concisely in the first part of the book under review. But in preparing this matter, it was found "that, with the growth and development of the locomotive during the past two decades, more has been added than taken away, and that the requirements as to space are much greater than they were in 1889. It was, therefore, decided to break the book into two volumes or parts, making each complete in itself. The first part is devoted to the practical construction and operation of the locomotive, with such slight theoretical discussion of the matter as to make it intelligible to men who have not had the advantage of a technical training. The second part will discuss the same points more theoretically."

The first part concerns the presentation of the practical details of locomotive work. There are a few introductory chapters dealing with the elemental laws of force and motion, the steam engine and the expansive action of steam. After this follows descriptions and tables of the various types of locomotives in use; and the various details, such as throttle, cylinders, the machinery, and the Stephenson and the Walschaert valve gears. The valve gears are clearly explained, and at some length, so that their action can be fully understood. The various kinds of compound locomotives, the several types of superheaters and the three stokers upon the market are fully described and their operation explained. Other details, such as the spring suspension, the running gear, tenders, tanks, lubricators and miscellaneous parts receive full attention. A chapter preceding that on mechanical stokers is devoted to the general subject of combustion, where, without entering into too minute detail as to theory, the reader is given a clear-cut idea of how combustion takes place and the method to be pursued to obtain the best results on a locomotive. A special chapter is devoted to the air brake with instructions as to its construction, care and manipulation.

There are 742 questions with their answers in this Part I, and it closes with chapters on the care and inspection of the locomotive, the handling of the machine on the road, the avoidance of accidents and first aid to the injured; and finally a very complete index by which a direct reference may be obtained to any topic in the book. Throughout the text is a profusion of illustrations, to which are added six folding plates of steam engines, valve gears, locomotives and air brakes.

The language is simple, concise and readable. Mathematical demonstrations have been avoided. As it stands it is undoubtedly, the most complete presentation of the subject that has appeared, and is in such a form that no locomotive engineer or fireman, regardless of how scanty may have been his early advantages, can fail to grasp the full meaning of what is there offered. Part II is on the press, and its appearance is promised for an early date.

PASSENGER CAR SHOPS AT BEECH GROVE

All Passenger Car Repairs for the Big Four Will Hereafter Be Made at the New Beech Grove Car Shops. A Special Shop for Tender Work and One for Car Wheels Are Included in the Additions.

When the Beech Grove shops of the Cleveland, Cincinnati, Chicago & St. Louis were started about five years ago, the design provided complete facilities for repairing locomotives, passenger cars and freight equipment. Owing to conditions which developed shortly after the work was started, however, it was decided to erect only the locomotive department buildings at that time and the construction of only five main buildings was undertaken.

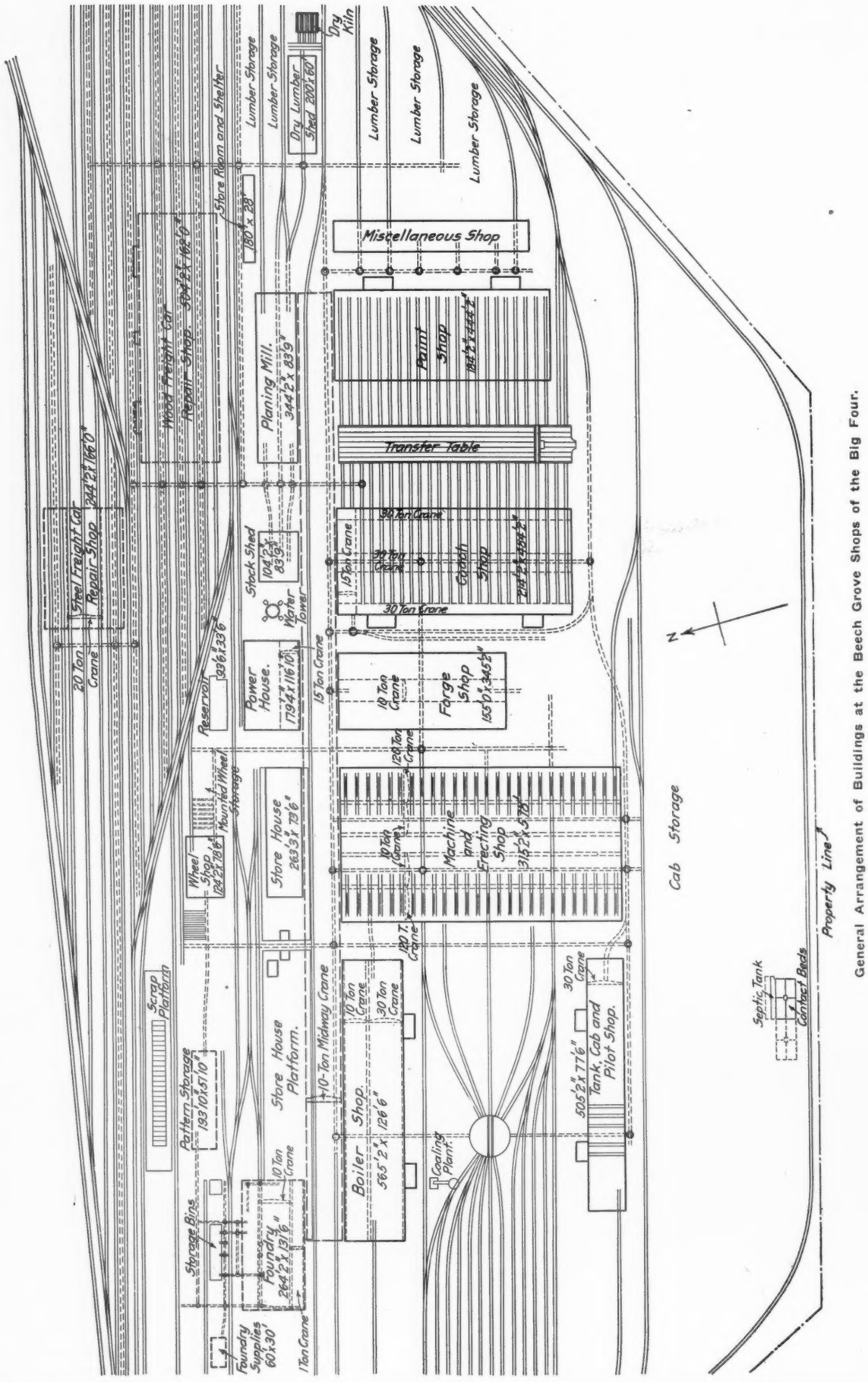
During the past few months the shops for passenger car work have been completed and put into operation at Beech Grove and all repairs of this character for the system are now being made at this point. The new buildings erected for this work consist of a coach shop, a paint shop and a planing mill. At the same time the tank, cab and pilot shop, provided for in the original plans, has been built and also the car wheel shop. While the miscellaneous building in which upholstery, electrical repairs, varnishing, etc., is to be performed, is not yet completed, it is expected that it will be built in the very near future. Work which is eventually to be done in that building is now given temporary quarters in the coach and paint shops.

General View of Tank, Cab and Pilot Shop; Machine and Erecting Shop in the Background.

The buildings just completed are located practically as originally planned. The tank shop is parallel to the boiler shop and adjacent to the opposite end of the erecting shop, being practically the only large building in the group which does not abut on the runways of the midway crane. The wheel shop is located convenient to the car repair tracks and the freight car shops to be erected later. It is also near the proposed location of the foundry and so arranged as to give ample yard room for storage outside of the building. The coach shop is parallel to and 75 ft. from the present forge shop abutting the midway crane runway, and the paint shop is parallel to it and 255 ft. away, allowing room for a 75 ft. transfer table and a 90 ft. space between the building and table pit on either side. The miscellaneous shop building will be parallel to the paint shop and 75 ft. from it, this being the minimum distance permitted between buildings. Across the midway from the paint shop is the planing mill which lies with its longest dimension parallel to the craneways. Between it and the power house is to be erected a stock shed for dry lumber and at the opposite end there will be a dry kiln and another dry lumber shed surrounded by the lumber storage yard. All of these buildings are of the same general construction and appearance as those in the locomotive department, having reinforced concrete foundations and curtain walls of Colonial shale brick with slate covered roofs, except in a few flat portions where composition asbestos roofing is used.

TANK, CAB AND PILOT SHOP.

This shop is about 73 ft. wide and 500 ft. long and provides facilities for all repairs to ash pans, tanks, tender underframes, and trucks, as well as the construction of new cabs, pilots and running boards. It is served by a 30-ton double trolley Shaw crane running the full length of the building. The full gage industrial track which passes outside at the end of the locomotive shop and has a turntable connection to the longitudinal tracks entering that shop, as well as connections and turntables giving access to all other parts of the plant, enters this building for a distance of about 30 ft. in the east end. At the opposite end a track from the regular yard



General Arrangement of Buildings at the Beech Grove Shops of the Big Four.

system enters one corner for a distance of about 50 ft. A track leading from the turntable pit also passes through this shop and has a turntable connection with the industrial track passing along the south side of the building, as shown on the general plan on the opposite page.

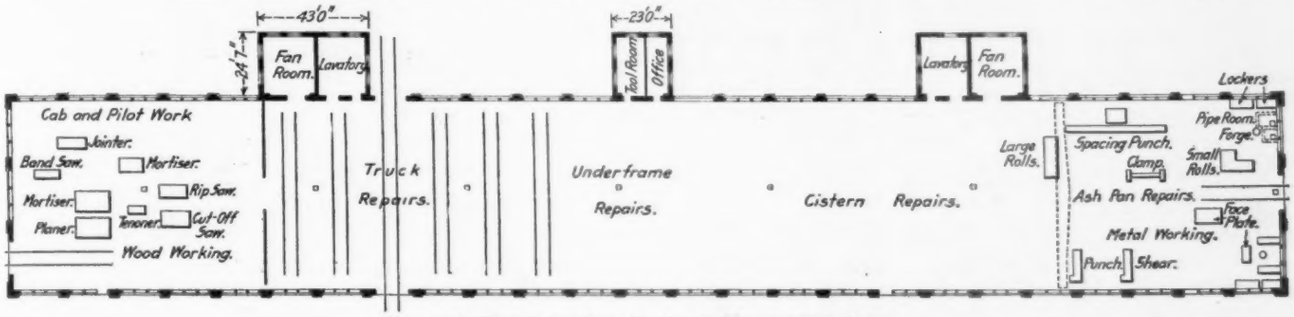
All metal working tools are located in the end of the building nearest the locomotive shops and here all ash pans are repaired and the plates fabricated for use in repairs to tanks or steel underframes. The machinery in this section, like all other constant speed machines in the shop, is driven by direct connected induction motors. The size of machines and motors is given in the following table:

Machine.	*Motor.*
Small rolls	7½ h. p.
Shear, Long & Alstatter No. 2	7½ h. p.
Punch, Long & Alstatter No. 2	7½ h. p.
Spacing punch, Long & Alstatter No. 2	7½ h. p.
Large bending rolls	7½ h. p.

In addition there are the open fires, face plates, small flanging clamps and benches required for work of this character. The floor is of concrete throughout the building and ample space is provided for the storage of a sufficient stock of plates, angles, etc.

The ash pans are repaired on the open floor; only those on which actual work is being performed are within the building; those waiting for repairs are stored outside alongside the entering track. The sheets and angles are sheared, punched and formed on the different machines and riveting is done with an air hammer. A jib crane with a chain hoist serves the large punch. Tank sheets which are too large to be handled by hand are transported by the traveling crane.

Beyond the open space for sheet metal work the cisterns or tanks are set on special trestles of a length to permit ten cisterns on either side with a wide aisle in the center and at the ends. The trestles, shown in one of the illustrations, are built of rails, base upward, set in cast iron pedestals located about six feet apart. Here the tanks are completely repaired and painted. Beyond this is a space which accommodates about 20 underframes which are set on wooden trestles, leaving an aisle in the center and at either end. This accounts for the shop space up to the place where the transverse track from the turntable enters. Beyond this track are four sets of rails imbedded in the floor on which all truck repairs are made. Following this are racks for bolts and standard truck parts and beyond is the wood working department in which the following machines are located:

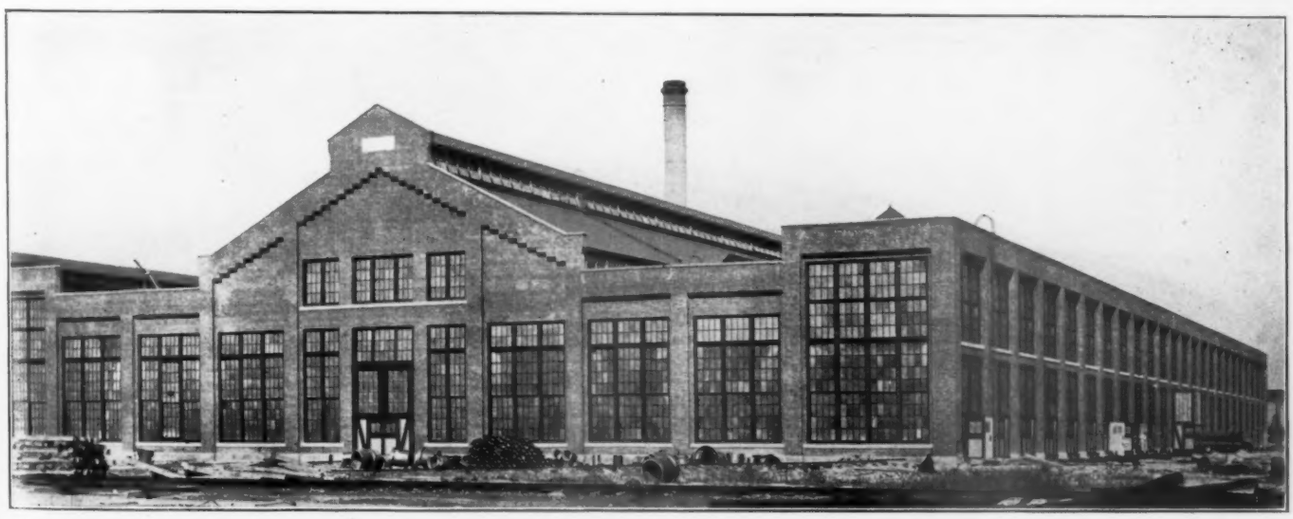


Plan and Tool Location; Tank, Cab and Pilot Shop.

Machine.	*Motor.*
Cross cut saw, Fay & Egan	20 h. p.
Rip saw, Fay & Egan	10 h. p.
Planer, Fay & Egan	15 h. p.
Band saw, Fay & Egan	5 h. p.
Hollow chisel mortiser, Fay & Egan	20 h. p.
Tenoner, Fay & Egan	5 h. p.
Horizontal mortiser, Fay & Egan	5 h. p.
Jointer, Fay & Egan	5 h. p.

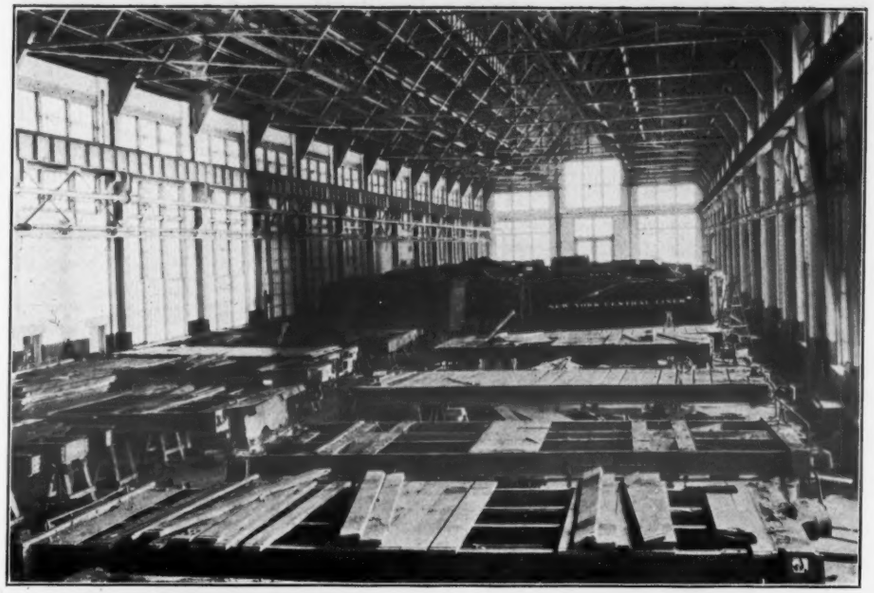
Heavy wooden parts, such as tender sills, bumper beams, etc., are planed and cut to standard lengths in the planing mill and stored in a shed just outside of this building from which they are brought into the shop on push cars. In the same way a stock of finished dry lumber for cab and pilot work is stored under cover near this shop, it being only necessary to form and fit it here. A comparatively small amount of room is required for the cab and pilot work, as only new work is done in this shop, repairs being made in the erecting shop.

A sub store with a stock of the journal boxes, brasses, springs, etc., needed for tender truck repairs is maintained in this building. New wheels come from the wheel shop, being transported on a flat car which is loaded and unloaded by a locomotive crane. Machined parts required for tank repairs are brought into the shop by a push car on the industrial tracks.

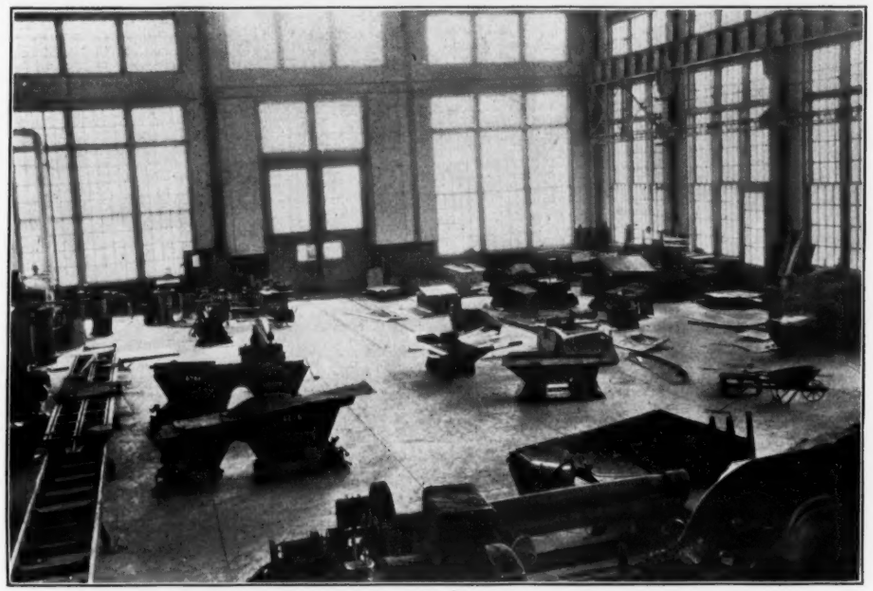


General View of Coach Shop at Beech Grove.

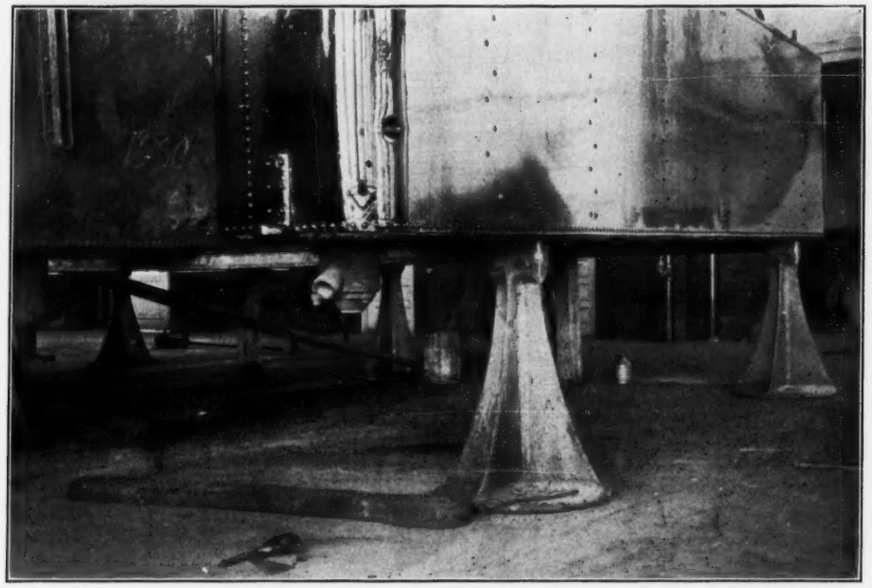
View Showing Wood Working Section of the Tank, Cab and Pilot Shop.



General View of the Tank Shop; Beech Grove Shops.



Section of Tank Shop Devoted to Ash Pan Repairs.



Special Trestles for Supporting Tender Tanks.

With the present tender equipment, which consists partially of wooden underframes and partially of steel, about two days are required for repairing the trucks—three days on an average for the underframes and from five to seven days for the tank or cistern—and it is therefore the practice to pile the trucks up in tiers after they are repaired and do likewise with the underframes, thus allowing more space for the tanks if it is required. The work of dismounting and locating different parts of a tender coming in for repairs, or of assembling it afterwards, is, of course, performed very rapidly by the crane.

The shop is heated by hot air, the fans and coils being located in two small wings at the side of the building. Two Sturtevant fans each have a capacity of 34,500 cu. ft. of air per minute and are driven by 20 h. p. motors. The air is distributed through concrete ducts under the floor. Artificial light is provided by Cooper-Hewett lamps suspended from the roof; there are also numerous sockets for portable lamps. The floor of the building is of 6 in. gravel concrete laid on a 12 in. bed of rolled cinders and finished with a ¾ in. coat of cement blocked in squares.

COACH SHOP.

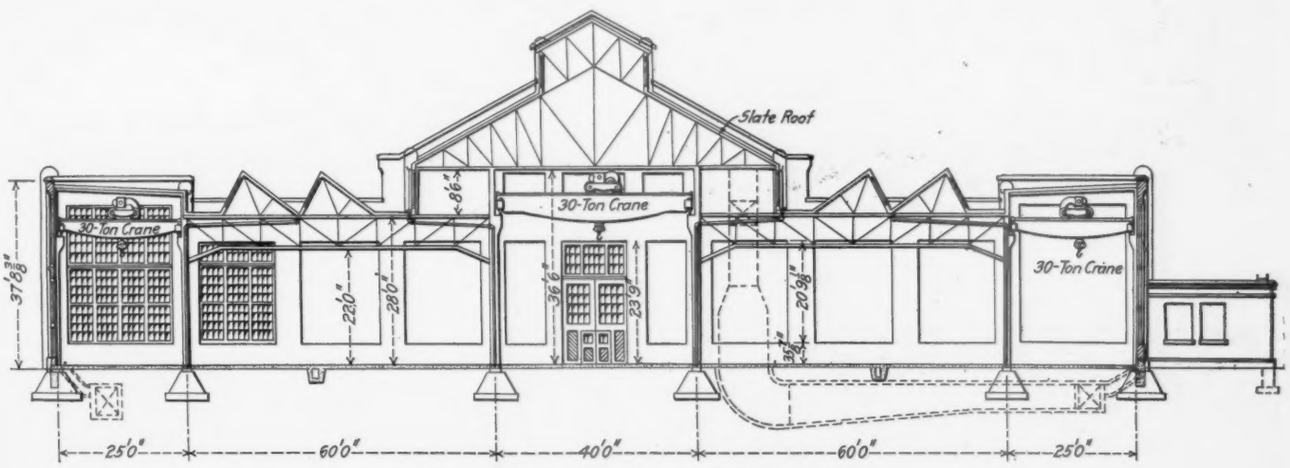
This building has an inside area of 210 ft. x 324 ft. 5 in. For a distance of 40 ft., the full width of the building at the end adjoining the midway, the space is given up to truck repairs and is served by a 15-ton single trolley Shaw crane running across the building. The remainder of the building has 22 tracks, which pass through double doors to the transfer table pit, and is divided into 5 bays longitudinally. The center 40 ft. bay has a 30-ton single trolley Shaw crane running the entire length of the building with the exception of the truck repair space. On either side of this are 60 ft. bays, not provided with crane service, and beyond these are 25 ft. bays which have 30-ton cranes operating parallel to and for the same distance as the one in the center bay. All four of the cranes in this building are arranged for operation and control from the floor.

The cross section of the building, shown in one of the illustrations, shows the method employed for obtaining a strong thoroughly diffused natural lighting over the whole floor area. The heating is by the hot air system, the fans and coils being located on platforms supported on the roof trusses—the distribution of hot air is made through concrete ducts below the floor level, with outlets along the side walls and at the center posts. The floor is of 6 in. concrete with a ¾ in. cement finish throughout the building except in the truck repair section where ⅜ in. diamond steel plates are placed on a concrete foundation. Artificial lighting is by 200 candle power tungsten lamps with large enamel metal reflectors distributed on lines between the tracks. A row of large arc lamps is suspended in the center bay.

Repairs on all of the passenger equipment of the Big Four, which now amount to about 800 cars are to be made at this point. It is designed to turn out on an average of two cars per working day, which means that it will be possible to put each car through the shop on an average of once every 16 months. The cars coming to the shop are first brought alongside the miscellaneous shop building where all carpets, upholstery and detachable parts are removed and distributed to the proper sections of this shop through the medium of push cars. The car then goes to the transfer table and is placed on any desired track in the coach shop. An electric winch with a long cable is provided on the transfer table for spotting the cars in the shop. The modern cars when placed in the 60 ft. bays will extend somewhat beyond either end so that they can be lifted by the cranes, the trucks rolled out and the body lowered on the trestles. The trucks are then picked up by the cranes and carried to the truck repair section where the transverse crane can reach them.

In making repairs, all wood machine work is done in the planing mill and cabinet shop and sills, posts, plates, cabinet work, etc., are brought to the coach shop on push cars passing over a transverse track under the midway from the end of the planing mill and connecting by a turntable to one of the tracks entering this shop. From here they can go by means of the transfer table to any track or can be brought directly into the shop and transferred to any desired location by means of the cranes. In cases where new forgings are required they are brought from the adjacent forge shop by push cars on a track directly connecting the two buildings. All machine work on metal parts is performed in the locomotive machine shop and they are distributed over the industrial tracks in the same manner. A track will be seen which runs the full length of the building in the center bay. It has a turntable connection to the general shop system just outside at either end and also to one of the transverse tracks in the center and permits convenient distribution to all points by push cars.

In the truck repair section is a Niles wheel lathe of the latest design, driven by a Westinghouse 50 h. p. variable speed motor. This machine has a capacity for turning 22 pairs of steel tired wheels in 10 hours. A 6 ft. radial drill is also to be located in this shop. Arrangements have been made for storing the finished wheels on a track just outside the building where they can be conveniently rolled in and out. Where new axles or new wheels are required, they will be prepared in the wheel shop and will be transported on a flat car which will be loaded and unloaded by a locomotive crane.

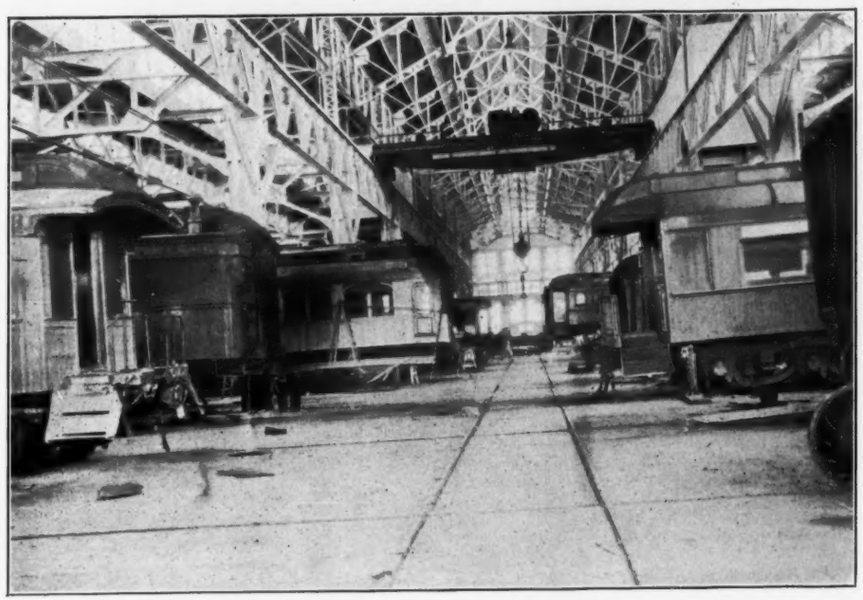


Cross-Section of the Coach Shop at Beech Grove.

Interior of Cabinet Shop Showing Massive Roof Trusses.

Interior of the Planing Mill; Beech Grove Shops.

Repairing Trucks in the Coach Shop; Beech Grove Shops.



Looking Down the Center Bay of the Coach Shop.

Racks containing a supply of bolts and parts for truck repairs are provided alongside this section of the shop. There are air and electric plugs at practically every post throughout the shop and riveting, chipping, etc., of metal parts is done with the aid of air hammers and portable forges. A small building between the coach and forge shops will contain a complete stock of the bolts required in coach repairs. Portable pipe bending machines and benches with pipe vises are provided for air brake work.

No special provision has been made for repairs on badly damaged all-steel equipment since such occasions will be rare and the complete system of industrial tracks will permit the easy transportation of sheets and shapes to the different metal working shops where they can be properly handled.

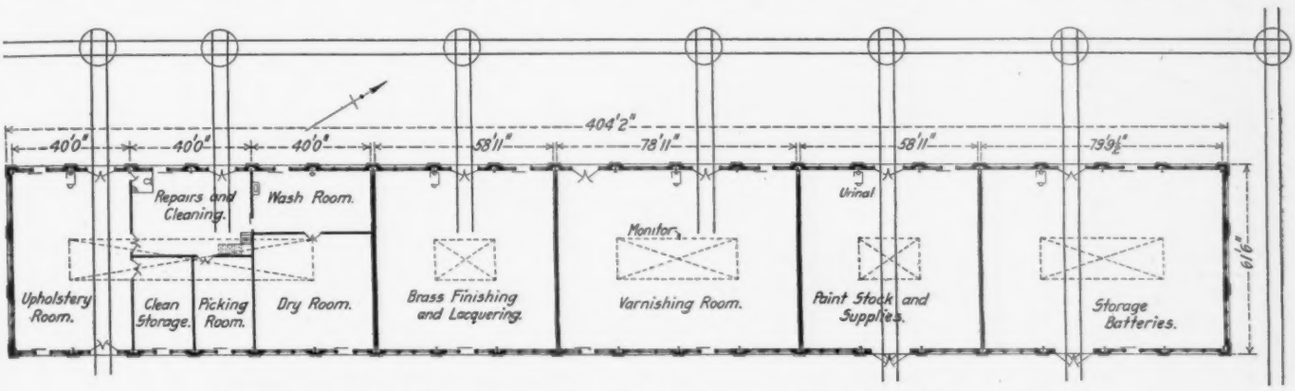
PAINT SHOP.

Between the coach and paint shop is a 75 ft. Nichols transfer table and the latter shop is made somewhat shorter than the former permitting two tracks coming from the transfer table to pass alongside of it. The building has a floor area of 180 ft. x 440 ft. and is quite similar in its cross section to the coach shop when the outer two bays of the latter are eliminated. No crane service is provided. The windows in the saw-tooth section and in the louvre may be opened from the floor, the mechanism for operating the sash in this and other shops being supplied by the King Construction Company, North Tonawanda, N. Y.

Direct radiation is used instead of hot air for heating this building. The radiating system is extensive, consisting of cast iron radiators, continuous below the windows and for the full height of the wall between the doors, and also of four groups of pipe radiators supported on the roof trusses for the full length of the building. Lighting is by tungsten lamps and the floor is of concrete the same as in the coach shop. A complete drainage system permits the floor to be rapidly and thoroughly flushed with water. The paint supplies will be in the adjacent miscellaneous building when it is completed, but temporarily they are placed in one of the two additions which are provided for wash rooms and toilets.

MISCELLANEOUS BUILDING.

One of the illustrations shows the general arrangement of the building to be erected in the near future for taking care of coach trimmings. An upholstery room with separate storage and cleaning rooms is provided in one end. Next to this is a section for brass finishing and lacquering; then come the varnishing room and the paint stock supplies, while the end. Each section of this building has a direct track communication to the shop industrial system and material will be transported to and from it through the medium of push cars for the lighter material. The coaches themselves, or freight cars with supplies, can be brought into the section for electrical repairs and for the paint stock and supplies. Cars can also be brought directly into the upholstery room, if desired. This building is 58 ft. x 400 ft. 8 in., inside dimensions. Upholstery work and electrical repairs are now being temporarily made in one end of the coach shop and a section of the paint shop is being used for a varnishing room and brass finishing.



Miscellaneous Shop Plan Showing Also the Connections to the Industrial Track System.

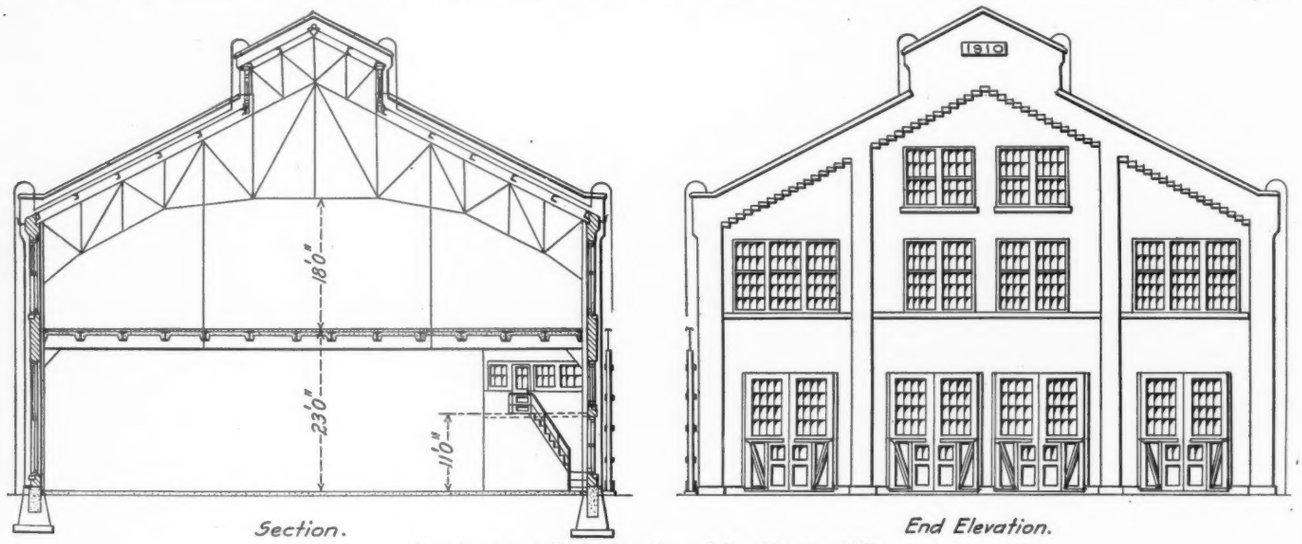
Paint Shop and Transfer Table at Beech Grove.

PLANING MILL AND CABINET SHOP.

The only two-story shop building in the group contains the planing mill and cabinet shop, the former being on the first floor. For convenience in handling large material it was specified that there should be clear floor space in the planing mill and it was thus necessary to support the second floor, which is of heavy steel and concrete construction carrying

moderate sized high speed machine tools, largely from the roof trusses. This required very heavy steel work in this building, the design and arrangement of which is clearly shown in the sectional elevation and in one of the photographs. The building has an inside width of 79 ft. 7 in. and a length of 340 ft. Two 5-ton electric elevators of sufficient size to take a locomotive cab are provided. These are so located that a spur from the shop industrial system reaches one of them and a track from a dry kiln reaches the other. There is also a track passing continuously through the center of the building which communicates to the dry lumber shed, the shop industrial system and to the storage yard. Two other spur tracks enter for a short distance at either end of the building and all material in and out of this building will be handled on push cars. These, however, in the case of heavy sills or other timbers, will be loaded by a locomotive crane in the storage yard and locomotive cranes will also be available for handling parts anywhere on the industrial tracks.

In arranging the machine tools in the planing mill careful attention was given to the continuous movement of the raw material coming in at the east end of the shop. There are three separate routes arranged, the one along the north being for long sills, plates and similar timbers; the middle section for short heavy timbers, and the southern section for light material like siding and flooring. Reference to the floor plans of the building will show the arrangement of the tools which are given in the list below.



Section. End Elevation.

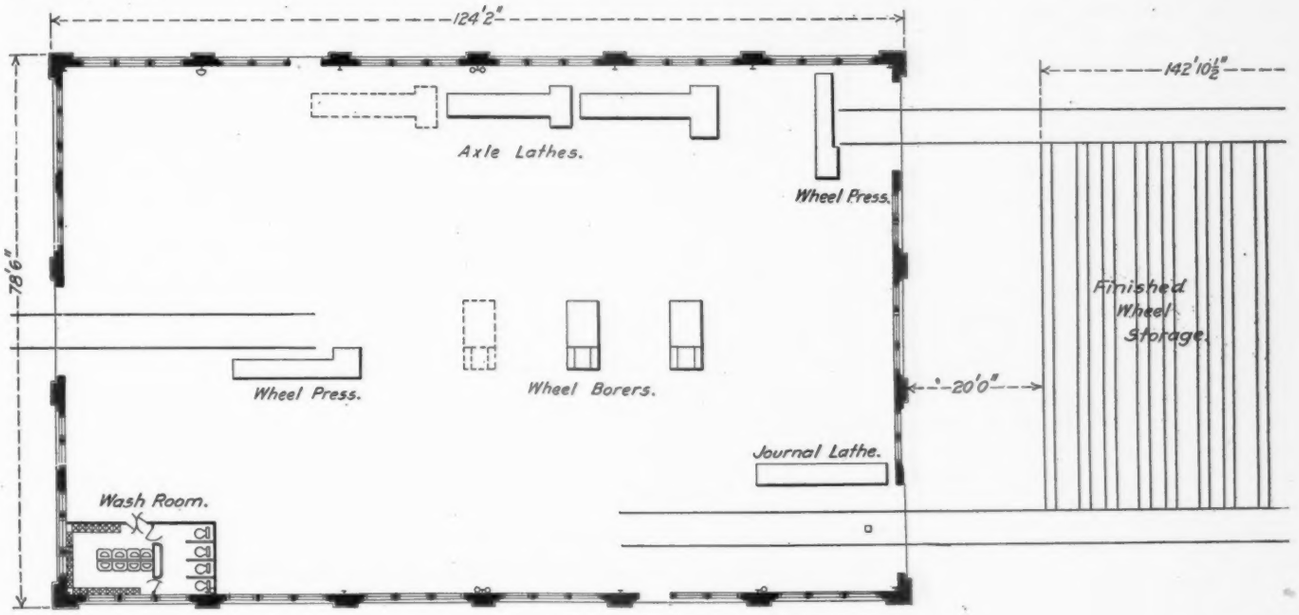
Sectional and End Elevation of the Planing Mill.

Machine.	*Motor.*
Sill planing machine, Berlin	50 h. p.
Band rip saw, Berlin	15 h. p.
Cut off saw, Greenlee	15 h. p.
Self feed rip saw, Greenlee	5 h. p.
Planing and matching machine, Woods	50 h. p.
Vertical cut off saw, Fay & Egan	15 h. p.

General View of Planing Mill and Cabinet Shop.

Boring machine, Greenlee	10 h. p.
Cut off saw, Fay & Egan	10 h. p.
Tenoning machine, Fay & Egan	10 h. p.
Rip saw, Fay & Egan	5 h. p.

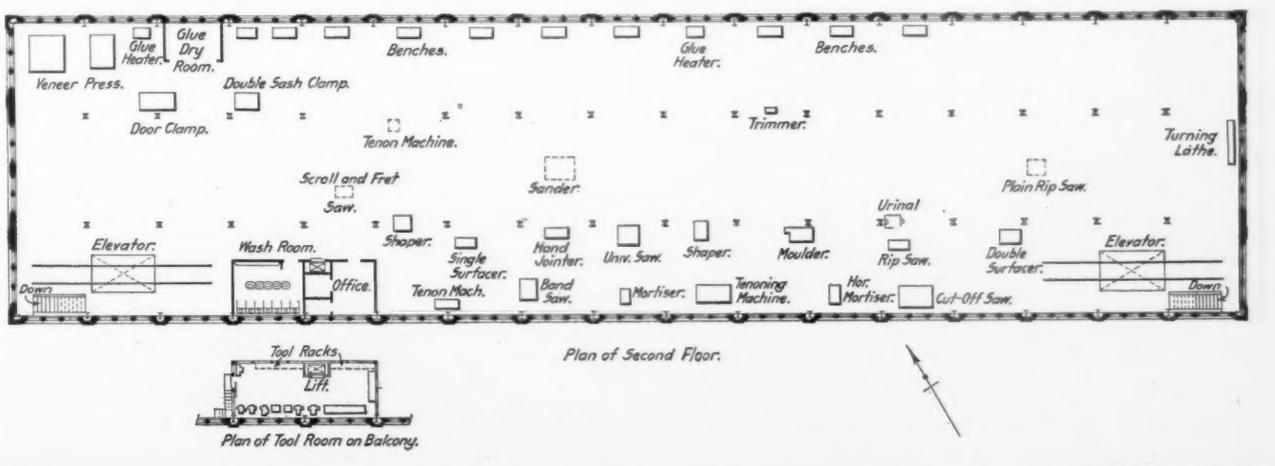
Space has also been provided for several future machines as shown in the illustration. All tools, with three exceptions, are driven by direct connected motors. The motors are of

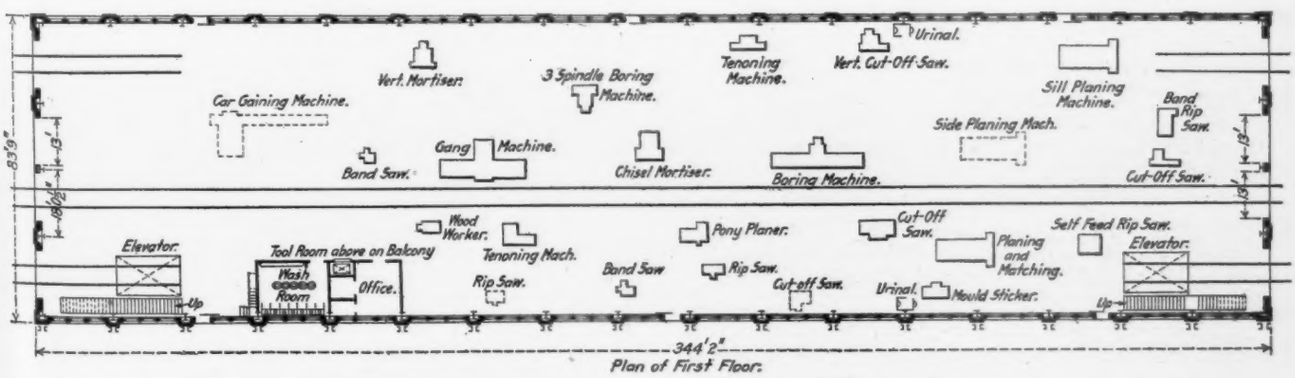


Plan of the Wheel Shop at Beech Grove.

Pony planer	15 h. p.
Band saw, Fay & Egan	5 h. p.
Chisel mortiser, Woods	5 h. p.
Gang machine, Greenlee	10 h. p.
Tenoning machine, Greenlee	15 h. p.
Vertical mortiser, Greenlee	15 h. p.
Three-spindle boring machine	.....
Wood worker, Greenlee	5 h. p.
Band saw, Fay & Egan	5 h. p.

the General Electric 60 cycle, 440 volt type controlled with General Electric oil immersed starting compensators having no load and an overload release. The large tools are also equipped with a push button stopping device whereby it is possible to instantly stop the motors by pressing a button located convenient to the operator. All wiring is run in con-





Floor Plans and Tool Location for the Planing Mill and the Cabinet Shop.

duits under the floor. The heavy tools have flexible couplings for connections to the motor, consisting of two discs with two pins projecting from each and a thick leather belt bent around them. This coupling is made by the Berlin Machine Company, Berlin, Wis.

In the cabinet shop the following machines are located:

Machine.	*Motor.*
Surfacer, Berlin	15 h. p.
Rip saw, Fay & Egan	7 h. p.
Cut off saw, Fay & Egan	10 h. p.
Horizontal mortiser, Greenlee	5 h. p.
Molder, Fay & Egan	15 h. p.
Tenoning machine, Greenlee	5 h. p.
Shaper, Berlin	5 h. p.
Rip saw, Greenlee	5 h. p.
Mortiser, Greenlee	5 h. p.
Jointer, Berlin	5 h. p.
Band saw, Fay & Egan	5 h. p.
Surfacer, Fay & Egan	15 h. p.

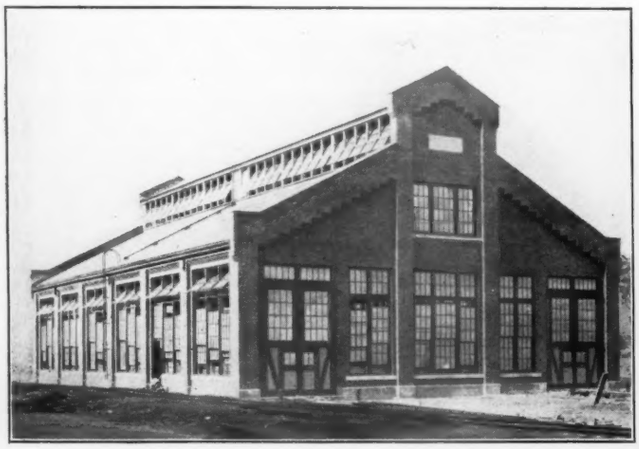
In addition there are also a number of hand machines and provision for future machines is shown in the illustration.

The pattern shop is located in one end of the cabinet shop. A tool room is located on a mezzanine floor in the planing mill and the foreman's office and the general wash room are below it. A dumb waiter gives communication from the tool room to both floors.

Special attention has been given to fire protection throughout the building and hose reels are conveniently located at numerous points.

WHEEL SHOP.

All tools for wheel and axle work are in a special building. They consist of two Niles car wheel boring machines of the latest type, a large wheel press, a journal turning lathe, two axle lathes and a journal polishing lathe. All are driven by direct current motors and are arranged as shown in the accompanying illustration. The building is so located



Wheel Shop Before Storage Tracks were in Place.

that there is ample storage room on all sides of it and the handling of stock in and out of it will be either by tracks or by hand. The storage of old wheels will be in the yard just west of the building and they will be rolled in to the wheel press on the special track. From this point the good wheels will be taken directly to the boring mill and scrap wheels will be rolled out of the building to a scrap platform on the north side. The axles will be taken from the press by a trolley and distributed in front of the axle machines or if condemned will be taken to the scrap platform. New wheels will be stored at the south of the building and will be rolled in to the boring machine by hand. Wheels leaving the boring machines will be stored at the east end of the building near the wheel press located in the northeast corner. The trolley carrying the axles from the other press passes the lathes and the stock of finished axles and continues to the press where the wheels are to be again mounted. After being pressed on, the wheels emerge and are stored on special tracks provided at the east end of the building. Such mounted wheels as require only turned journals are brought from the storage yard at the southeast corner of this building where the lathe for this purpose is located in a pit, permitting them to be easily handled in and out of it. After the journals are finished the wheels will be returned to the storage yard.

The heating of this building is by direct radiation, the lighting by tungsten lamps and the floor is of heavy timber. At the present time one corner of the building is devoted to air brake repairs and cleaning, which work will eventually be done in the car shops to be built later.

MACHINE SHOP KINKS

BY J. C. BREKENFELD,
Assistant Machine Shop Foreman, St. Louis & San Francisco, Springfield, Mo.

DRIVING WHEEL LATHE ATTACHMENT.

Locomotive driving wheel lathes that have tool slides for truing journals and facing hub plates are as a rule equipped with the ordinary tool post as used on engine lathes, which forms a poor support for the tools used in this class of work. The tools are liable to chatter and will leave marks on the

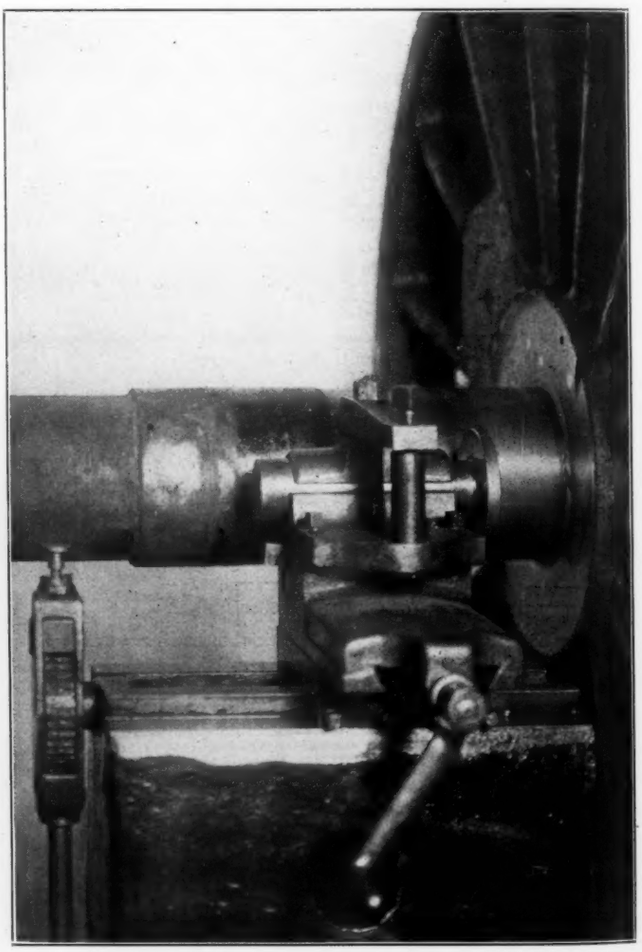


Fig. 1—Special Tool Holder on Driving Wheel Lathe for Truing Journals.

journal that are hard to roll out. Also with the old fashioned tool post it is almost impossible to hold a roller square with the journal and keep it rolling smooth. The ordinary tool slides have T-slots for the tool post to set in, and the projection on the base of the improved attachment shown in Figs. 1 and 2 fits snugly in them. Two 5/8 in. set screws on

the top face of the base of the tool holder prevent it from sliding out. The key *A* is placed in the bottom of the tool holder to prevent the tool holder bars from turning when the tool is taking a heavy cut. The tool slot in the tool bar *B* is made

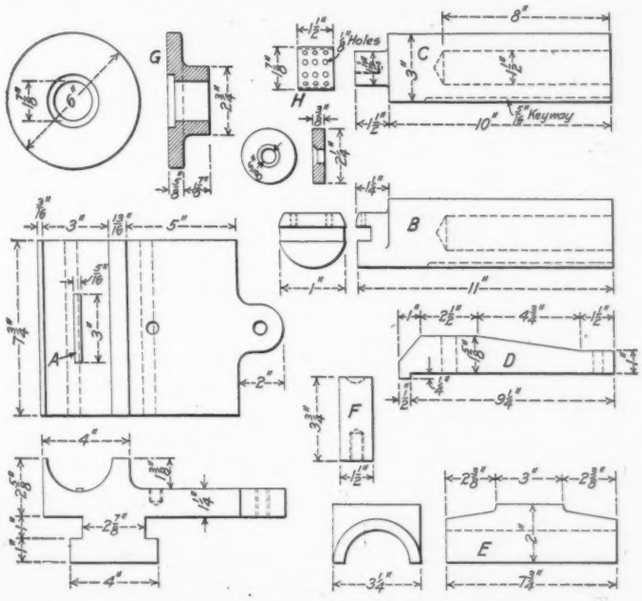


Fig. 2—Lathe Attachment for Turning and Rolling Journals.

to hold a 1 in. square steel tool. We found the 5/8 in. square steel too light for heavy cuts in cutting out wheel hubs for new hub plates. The bar *C* is used for the roller. These bars may be made of either tough machinery steel or tire steel and are drilled out at the back end to lighten them. A keyway is milled on the under side to fit the key in the holder.

The clamping bar *D* is used to hold the tool bar in place after the cap *E* has been placed on top of the tool bar. The clamping bar is held by a 7/8 in. stud which passes through it well forward of the center of its length. A 7/8 in. hardened set screw passes through the back end of the clamping lever and rests on the 1½ in. round post *F* which is held on the back of the holder base by a stud. By turning this screw, pressure is applied to the cap *D* and the tool bar is securely clamped in position. With this arrangement there is only the set screw to be unloosened when it is desired to change the tools, the clamping bar being then free to be swung out of the way.

The front end of the roller bar *C* is turned down to receive the roller and is tapped out for a 5/8 in. machine screw, a right hand thread being used in one bar and a left hand thread in the other. This prevents the countersunk head screw that holds the roller retaining washer in place from backing out while the roller is in action. The roller bearing is hardened and ground and should have a 3/16 in. oil hole drilled in the center of the bearing to connect to an oil hole ½ in. back of the shoulder on the bar. A hardened and ground tool steel bushing *H* fits over this projection and is drilled with rows of 1/8 in. holes which form oil cellars and help to keep the pin cool as it works under heavy pressure and high speed. *G* is the roller and it should be made of either a good tire steel or tool steel. It is hardened and ground both on the outer or working face and in the bore, which should be a snug running fit on the bushing. By using the bushing a double bearing is obtained which gives better results with high speeds. This holder has been a decided success and has increased the capacity of machine 50 per cent. on

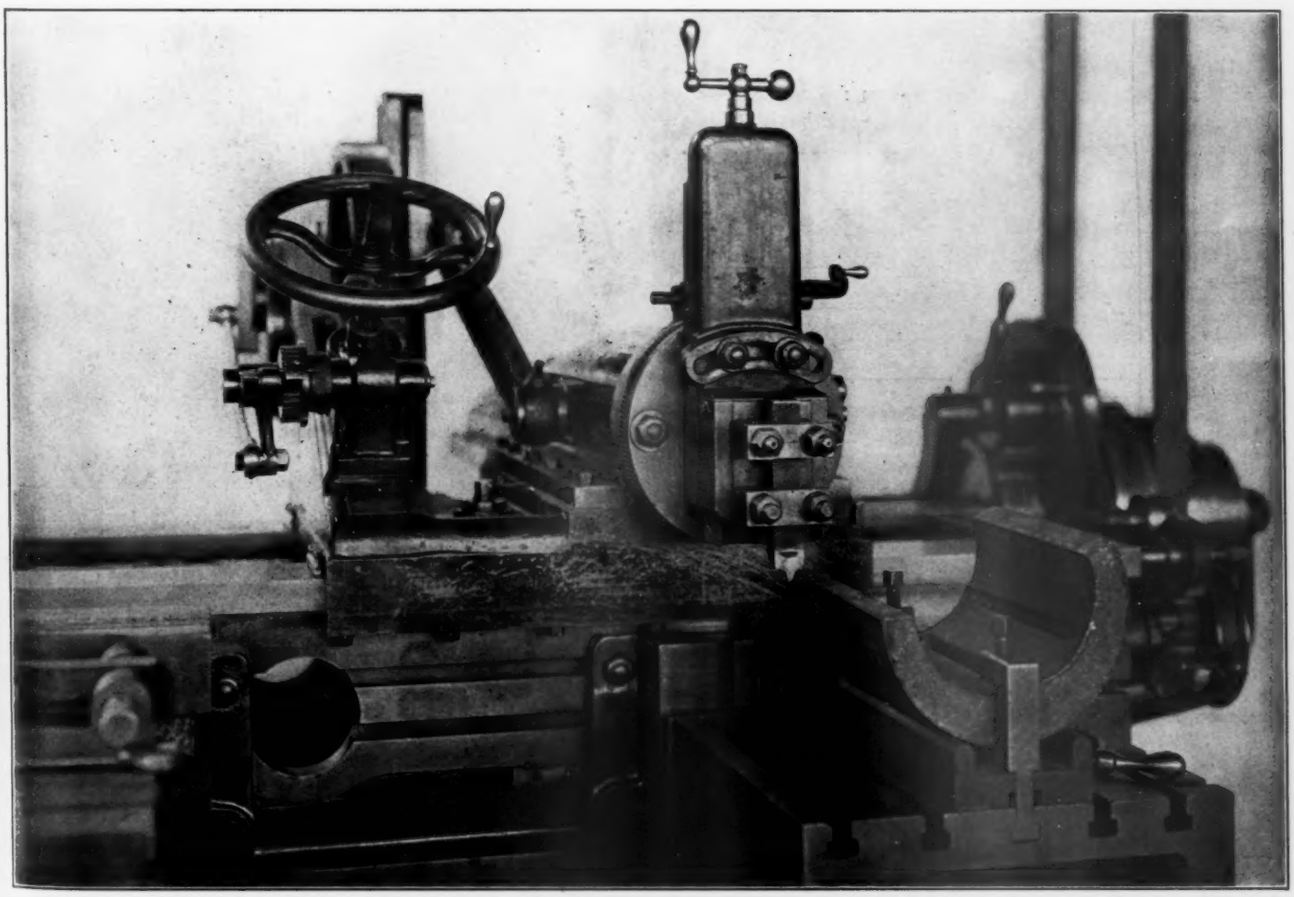


Fig. 3—Application of Chuck for Finishing Driving Box Brasses on Shaper.

account of its rigidity and the heavy cuts it can stand. The whole attachment is easy to apply and handle.

CHUCK FOR DRIVING BRASSES.

The arrangement shown in Figs. 3 and 4 is used for holding driving brasses on a shaper for finishing the ends that fit in the driving box. The chuck is made of an old driving box shoe and has a tongue planed on the bottom of it to fit in the slot of the table to hold the work parallel to the tool. Two

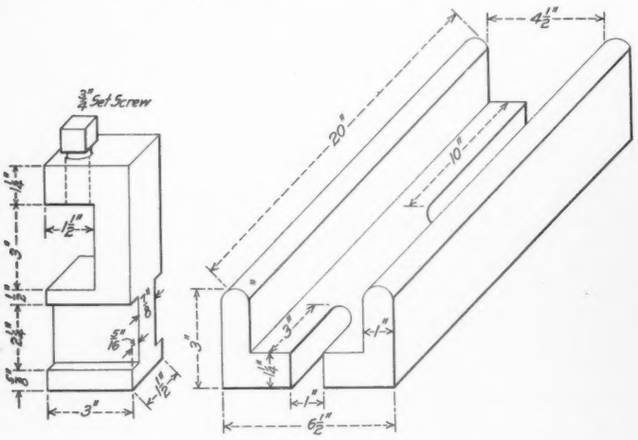


Fig. 4—Chuck for Driving Box Brasses.

slots, one 3 in. and the other 10 in. long and 1 in. wide, are cut into the middle of the shoe at the ends for the T-clamps, one of which is shown at the left of the shoe. The clamp fits in the T-slots of the table and the set screw bears down on the brass, holding it rigidly in place. With this arrangement cuts 1 in. deep can be readily taken. The chuck is easily made and produces excellent results.

DRIVING BOX CHUCK.

The chuck shown in Figs. 5 and 6 is used for boring driving boxes. The base *A* is made of cast iron and has a projection

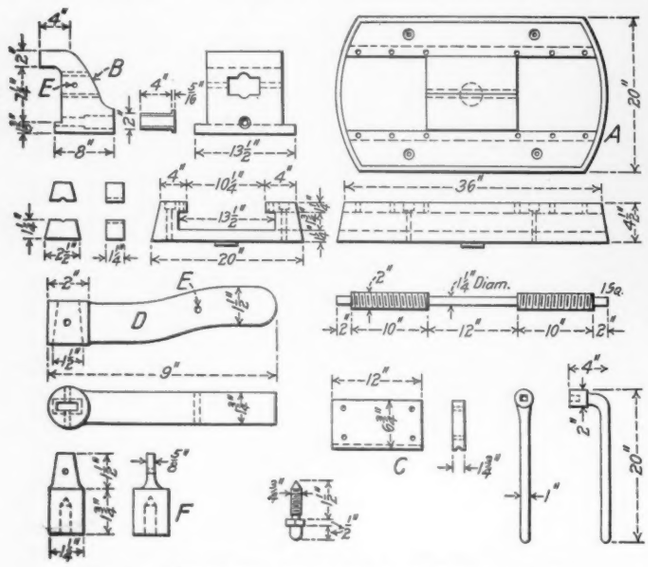


Fig. 5—Driving Box Chuck for Boring Brasses, Etc.

on the bottom to fit in the hole in the center of the boring mill table. The outer ends of the chuck extend to the edge of the table and it is fastened to the machine by four 1 in. bolts so located as to have them enter the slots in table. The holes for these bolts are counterbored at the top of the chuck so that the nuts will clear. The jaws *B* slide in the ways of the base and are actuated by a right and left hand screw which is held in the center of the chuck body by a large split plate *C* which is set in a slight recess and is held by fillister head screws. Provision for taking up wear and keeping the jaws a snug working fit in the base is made by two taper gibs, one for lateral and one for vertical lost motion. The jaws alone were not sufficient to hold the boxes firm while they were being bored with coarse feeds, so the clamping levers *D* were provided. These levers pass through the jaws and rest on the driving box flange. Each one is held by a ¾ in. pin at *E* so that when the outer end of the clamping lever is raised, by means of the screw and sleeve *F*, pressure is applied to the driving box which holds it down firmly on the chuck body. The pin

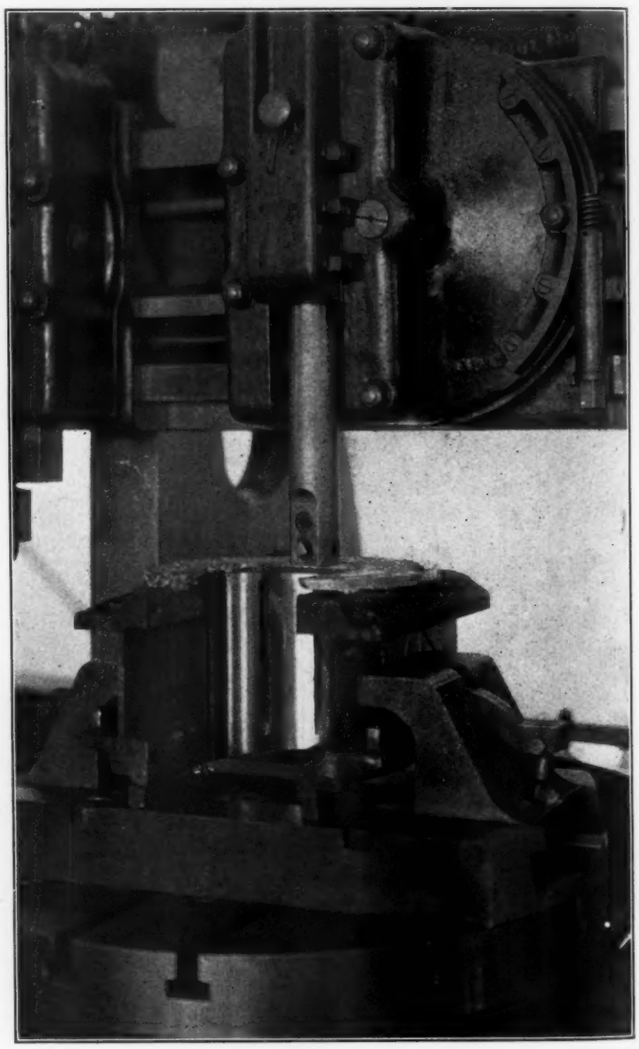


Fig. 6—Application of Driving Box Chuck to Boring Mill.

E is held in the split bearing, shown in the details, which fits in the opening in the jaws. The chuck being self-centering, all boxes are bored central with the shoe and wedge faces, and it is not necessary to "lay off" the boxes for this purpose. Twenty minutes is the average time required to bore a driving box brass and face it for lateral bearing. The faces of the jaws where they bear on the shoe and wedge faces of the boxes are lined with ½ in. hardened steel plates and are scored to hold the box firmly.

Railway Revenues.—The total operating revenues of 93 per cent. of all steam railway mileage in the United States for the month of January, 1912, amounted to $203,143,118. Compared with January, 1911, the total operating revenues of these railways show a decrease of $2,886,149, or 2.8 per cent.

PROTECTIVE COATINGS*

BY WALTHER RIDDLE

In coating iron or steel the surface should be clean and dry before anything is applied. This is a point which cannot be too often repeated. Should the preparation of the surface be neglected, the metal will itself attempt to protest by pushing away the coating to show us its wounds. Another point to be watched is that the placing of one type of coating upon another may not bring about an inter-reaction which will perhaps destroy both. A coal-gas tar paint, which by itself would do its work well, when placed over an oil coating, has dissolved and combined with the latter to form a sort of "porridge," which could be entirely rubbed off by the hand. Various engineering societies are at work standardizing specifications for mixing, and for the application of coatings. This work is complicated, especially in our own country, by the extremely variable climatic and atmospheric conditions. A pigment which may be the proper one in the higher inland districts is found utterly inadequate upon the coast. Again, that which is good for the farm wagon may not be at all suitable for the overhead signal bridge of the railway, exposed to flying cinders and sulphurous fumes from locomotives. The varnish which is serving well upon furniture would soon become discouraged upon the leads of a street railway motor where flexibility as well as resistance to dust and moisture are necessary.

In any coating which has an oil base, the choice of the oil is of particular moment. The principal oils of commerce which can be classed as drying oils, that is, those which when spread in a thin layer take up oxygen and become solid, are: linseed oil, China wood oil and soya bean oil. Linseed oil is by far the most satisfactory, and the real reason for the agitation in favor of using other oils, has been the very high price of linseed oil during the last year or two. China wood oil is crushed from the seeds of two oriental plants. It has a specific gravity of 0.937 to 0.940, and a solidifying point of about—13 deg. cent. Its color is brownish yellow, and it has a very characteristic and persistent odor. In the laboratory it may be distinguished from linseed oil by the fact that with nitrous acid it forms a semi-solid substance. A sample of soya bean oil which was recently examined, had a specific gravity of 0.928, and a color similar to crude petroleum, although lighter. It had the latter's fluorescent appearance when the light struck it and was not very clear. It had no rapid tendency to dry when in a thick layer, but spread out thinly with a little manganese dryer giving a rather good coat. It contains about 25 per cent. of free acid. In China and Japan it has long been used in making lacquer and also in the kitchen for cooking and at times for purposes for which we use olive oil. It is pressed from the seeds of the soja hispida.

As it comes to the consumer the raw linseed oil of commerce has a specific gravity of about 0.935 at 60 deg. F. Its color is a golden yellow when clear, slightly tinged with green from the chloroplyl of the flax plant. It has a not unpleasant taste and a smell similar to refined New Orleans molasses. Any considerable admixture of another single oil for purposes of adulteration will be shown in the specific gravity. A mineral oil will make it too light and rosin oil or rosin will make it too heavy. A carefully made mixture of both might be used without changing the gravity. However, the large crushers being in a very considerable and staple business, will not descend to such methods. A little oil rubbed in the palm of the hand and then smelled will generally give a good deal of information to the trained nose. In many parts of the world other crops are grown with or near the flax and the seeds from these may be carried along to the presses and thus affect the oil. Such contamination is accidental and does not obtain to any large extent in this country.

The most important property of linseed oil is its power to take up oxygen from the air to form a skin. For some years there has been dissatisfaction expressed in regard to raw linseed oil. While it is the best, and for many purposes the only oil to use, it is a somewhat different product from the oil of 30 or 40 years ago, and this has led many to assume adulteration. The chief source of this difference is the desire of the crusher to obtain as much oil as possible per pound of seed. The pressure has been increased, and instead of the crushing operation being undertaken cold, the seed is saturated with steam and the apparent yield is increased. The flax seed, however, contains only a certain quantity of oil, and the increase is not oil but a mucilaginous matter which should have remained in the press. This mucilaginous matter or "foots and mucilage," as it is termed, is highly soluble in water, and when the oil containing it is used in coating, the film, of course, contains this soluble matter. When rain comes in contact with a coating containing this soluble ingredient, it gradually dissolves and minute flaws occur in the coating through which air and moisture enter, and the destruction of the material coated begins.

Long storing and filtration will help to purify the oil, but these are usually not sufficient. The manufacturer should put the oil through some process to completely remove the source of trouble and leave an oil which will dry thoroughly and form an unbroken film when applied. In order to ascertain what takes place when the oil dries, whether the reaction is the simple addition of oxygen from the air or of a more complex nature, a carefully weighed body of oil was placed in a container and a constant current of air was passed through it. The air was analyzed before and after contact with the oil. An absorption apparatus was set up to make determinations of the oxides of carbon oxygen, and of water as moisture. The samples were collected over mercury every three hours. The process was continued over a period of ten days until the oil had become so heavy that the air could no longer be made to uniformly react with it, and to a point where the oil could no longer be readily poured. By comparison of its specific gravity with that of completely oxidized oil, in a film, it was judged to be about ⅔ of its journey towards complete dryness. In any case it was far enough to give an inkling of what takes place.

The average results from the absorption were as follows:

Oxygen.

Inlet Air	=20.95	per cent.
Outlet Air	=19.97	per cent.
Difference	0.53	per cent., representing oxygen absorbed by oil.

Carbon Dioxide.

Inlet	0.05	per cent.
Outlet	0.12	per cent.
Difference	0.07	per cent. = CO_2 generated by the drying action.

Water.

Inlet Current	52.30	decimilligrams per liter.
Outlet Current	67.00	decimilligrams per liter.
Difference	14.70	= water generated and driven off.

Figured on a basis of 10 lbs., which we will assume to have been the amount of oil used, there were passed 320.99 cu. ft. of air.

Difference Between Inlet and Outlet Currents:

In oxygen = 17.01 cu. ft. = 1.52 lb. absorbed by the action.
In CO_2 = 2.25 cu. ft. = 0.277 lb. given off.
Water given off = 0.295 lb.
Oxygen needed for 0.295 lb. water = 0.260 lb.
Hydrogen needed for 0.295 lb. water = 0.033 lb., which would represent the hydrogen given off.
Oxygen needed for 0.277 lb CO_2 = 0.202 lb.
Carbon needed for 0.277 lb. CO_2 = 0.076 lb.

It is a question whether the CO_2 was formed simply from the oil, or was formed by the decomposition of certain products of the oxidation. So far as can be judged, either would have the same effect upon the formula of the final product. The

*From the address of the retiring president of the Engineers' Society of Western Pennsylvania. Presented at the annual meeting, January 16, 1912. Mr. Riddle is vice-president of the Sterling Varnish Company, Pittsburgh.

total weight of oxygen absorbed by 10 lbs. of oil during the experiment was 1.52 lb. The water, in excess of that in the inlet current = 0.2946 lb.

CO_2 in excess of amount in inlet air	=	0.277
Oxygen absorbed	=	1.51840 lb.
CO_2 and water given off	=	0.57195 lb.
Difference	=	0.94645 lb.

This difference should represent the gain in weight of the 10 lbs. of oil during oxidation, which we found by weighing was about right. No traces of CO were found in the outlet air at any time. The increase in weight is very nearly 10 per cent., which is much in excess of that generally claimed.

The drying action is not, therefore, a simple additive process, but is more complex. It is known that a film of paint will not dry as well in wet weather as in dry. From the above experiment it is apparent that the surrounding atmosphere must take up water and CO_2 from the film as well as give up oxygen to it. If the air is already pretty well saturated, its appetite is decreased.

Pigments.—The leads, oxides of iron, tars, asphalts and carbons in various forms, all have their advocates, and all are good. The principal point to watch is that the pigment is pure, dry and finely ground. It should be stirred well into the oil and be thinned just before being applied, in order that the coat may be uniform. One great advantage which carbon, in the form of lamp-black, has is that its specific gravity is lighter than that of metallic pigments and there is less tendency to settle. Pigments must be well ground and well mixed with the oil vehicle.

Gums.—The gums which may be used in paints and varnishes are many. The hardest, most expensive, and if used without special treatment, the best are the fossil resins. Nearly all natural gums in solution give off an acid reaction, and this acidity should be neutralized before use. Amber is an example of a very high type of fossil resin. Kauri gum in various grades is used for fine, hard finishes. The chemistry of colophony, or common rosin, has been well looked into and it is the most generally used gum. It is usually used in the form of a metallic resinate.

Dryers.—Manganese and lead compounds are the most common driers. These aid the oil in its efforts to take oxygen from the air. They either act by taking it up and passing it on to the oil, or perhaps by a catalytic action. Too much dryer should not be used, and with oil coatings slow drying in general means long life for the coat.

Thinners.—Turpentine, benzole, benzine and higher naphthas are used, and each has its place. Turpentine also seems to aid in the drying and is a good solvent. Its fault is that having performed its mission as a thinner it does not leave quickly enough. Benzine is better in this respect. Probably a mixture will be better than either by itself for many purposes.

Protection of Steel.—The steel should be clean and dry. The coating should present a good resistance to the abrasive action of dust as well as to the gases and water-vapor in the atmosphere. It is the custom with many to use different colors for the different coats, to facilitate inspection, so that the engineer can tell at a glance whether the required number of coats has been applied. This long-distance and "at a glance" inspection is not thorough. The inspection should be close enough so that color is a small factor. Objection is made at times to "shop coating," as we are told that this obliterates the marks and numbers. This objection is overcome if a clear transparent coating is used, and shop-coating removes the danger of rusting between the time when the steel is finished and the final painting in place.

For steel which is to be embedded in concrete special top-coatings are now being developed. Claim is made that the concrete itself preserves the steel, but there seems to be a demand for concrete steel coatings. The water used in mixing concrete must be a great factor. One of the tests which is being used by certain large railways and other corporations is to coat steel plates with the paint to be examined, allow them to dry thoroughly, and place them in a mixture of concrete made of 4 parts cinders, 2 parts sand, and 1 part Portland cement.

After periods of one, two or three months, etc., the blocks are broken and the coat examined. This is a severe test, but it should be in order to allow of speedy conclusions. Generally the coating which survives the setting period and the first month, will last through many months. In many tests part of the coating will adhere to the concrete and part to the steel when the block is broken. If the exposed places on the steel are bright, it shows that the coating has done its work. Good materials cost more but are, of course, more economical. The labor cost is usually overwhelmingly greater than the material cost. The number of repaintings on exposed work will tell the story.

Testing.—There are a few simple tests which will help the user to check up the manufacturer as regards uniformity. One of these is the specific gravity which, in some cases, may be taken by the hydrometer, in others where there are heavy pigments the sample is taken from a well stirred lot and a known volume is accurately weighed and compared with the weight of the same volume of water.

Oil and Water Resistance.—Strips of copper ribbon or small steel plates are coated and thoroughly dried, or if time is a factor, baked for a proper period, and then hung in a vessel filled about two-thirds full of water upon which a layer of oil is poured. A burner is placed underneath the vessel and the water is boiled. If, after the boiling has been continued for two hours, the coating is still intact, it may safely be used in places where moisture and oil are present.

Elasticity.—Copper ribbons, or paper or steel plates, are coated and thoroughly dried or baked. These may then be bent and twisted, thus giving an idea of the elasticity. These tests may be undertaken at different temperatures by placing first in warm water and immediately afterwards plunging the samples in vessels containing ice, etc.

Slip and Flow.—What is known as "slip" is the wedging of a coat of varnish or paint. If any object be dipped vertically the coating near the top will be thinner than that further down. If a strip of paper be dipped and air dried, or baked, its coat may be measured with a micrometer at different points. The difference between the thickness at a 2 in. line and at a 12 in. line. will give the "slip" in 10 in. The smaller the "slip" the better the result. The flow may be examined on the same papers.

Penetration.—For certain uses, especially for the insulation of coils in electric machines and similar places the penetration is important. This may be measured by clamping a pad of filter papers, by suitable means, to the bottom of a tube which, during the test, is kept filled to a constant level. At the end of the test the number of papers impregnated is counted. Experience shows that a 10-in. head or pressure, and a 20 min. period are very convenient.

Good Roads.—The Department of Agriculture reports the following data concerning public roads:

	Mileage Improved.	
	1909.	1904.
Indiana	24,955	23,877
Ohio	24,106	23,460
New York	12,787	5,876
Wisconsin	10,167	10,633
Kentucky	10,114	9,486
Illinois	8,914	7,924

The gain in New York is due largely to the fact that the state has bonded itself for $50,000,000, and that $5,000,000 a year or more is being expended by the state, in addition to an equal sum by the counties, in building state highways. New York is leading all the states in actual progress at the present time.

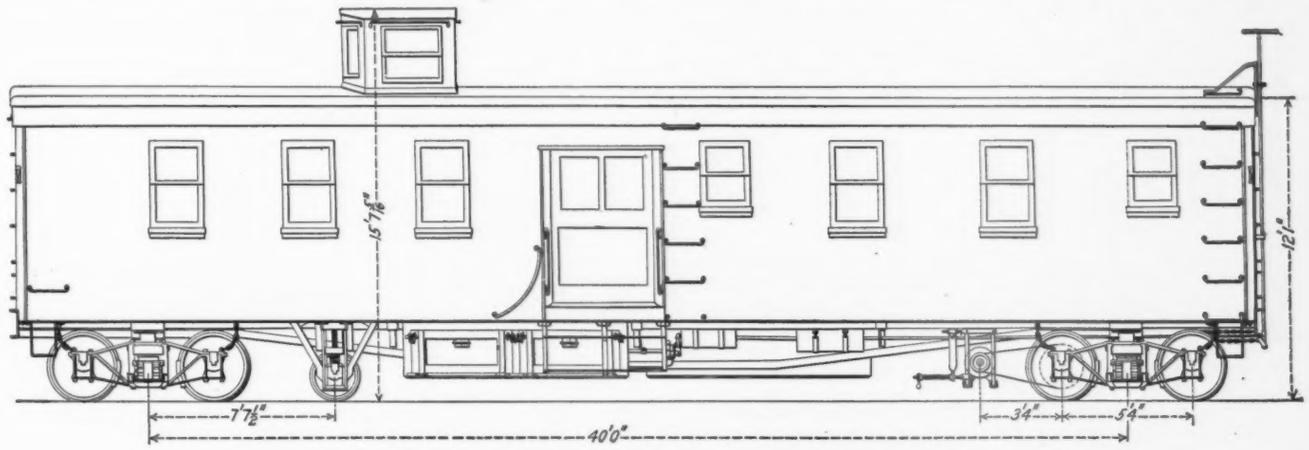
SANTA FE MILLION LB. DYNAMOMETER CAR

The Exceptionally High Recording Capacity and the Strong Construction, Including the Steel Frame for the Superstructure, are of Unusual Interest.

BY H. B. MAC FARLAND,
Engineer of Tests, Topeka, Kan.

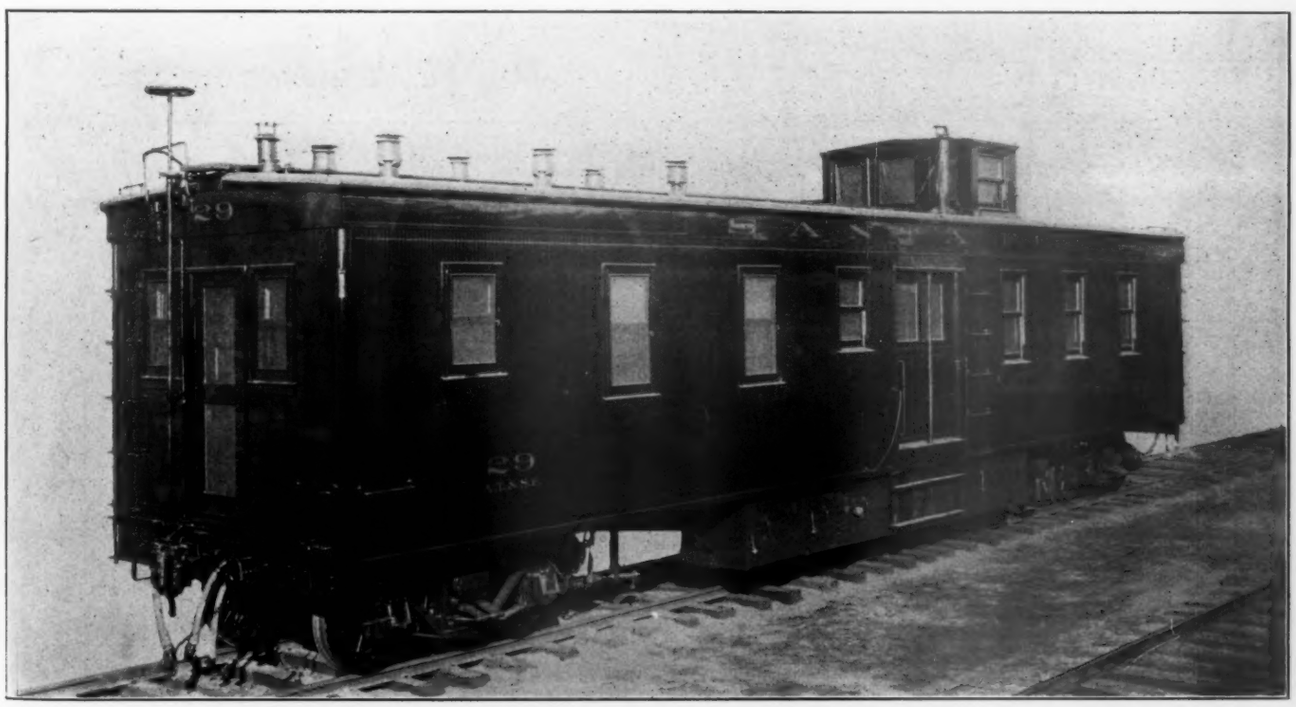
An exceptionally high capacity dynamometer car, 1,000,000 lbs., having a steel frame for the superstructure, has just been placed in service on the Atchison, Topeka & Santa Fe. The dynamometer was built by the Locomotive Finished Material Company, Atchison, Kan., and the recording apparatus by the Burr Machine Company, Champaign, Ill., from drawings furnished by the railway. The steel frame for the car was built by the Crawford Locomotive Works at Streator, Ill. The car was finished and the apparatus installed at the Topeka shops. The underframe, side and roof frame are entirely of steel, the underframe being composed of a built-up box girder for the center sill, channels for the intermediate sills, and Z-bars for the side sills. The side frame is of angles and the roof frame of I-beams.

The center sills are of the fish-belly type, 28 in. deep at the center and 13 in. deep at the bolster. The web of the girder is

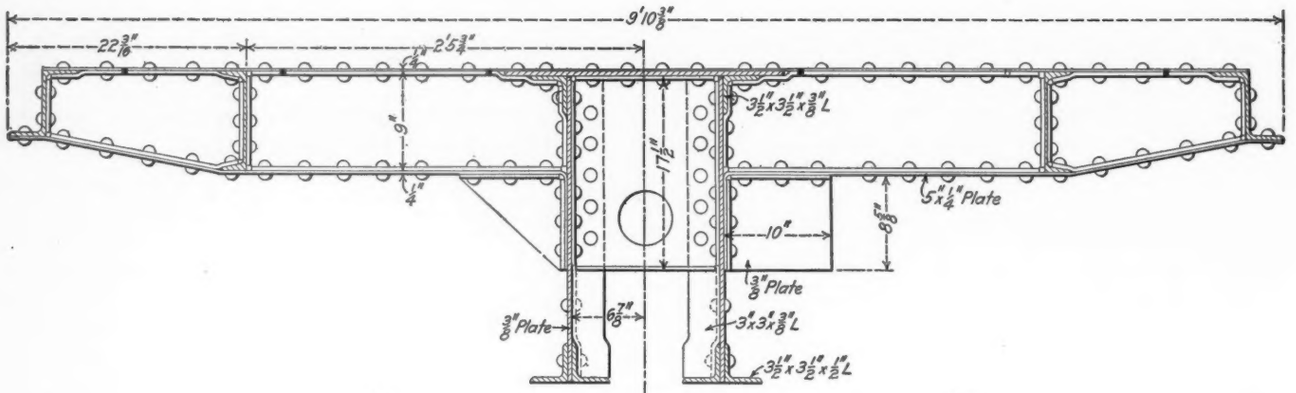


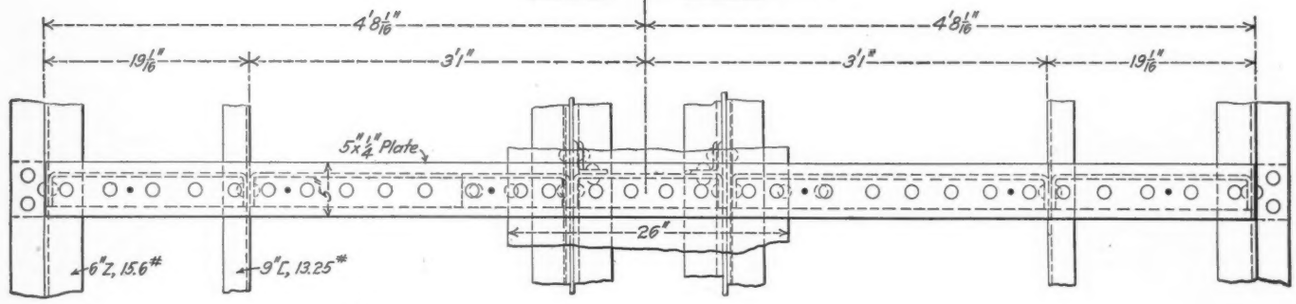
Side Elevation of Santa Fe 1,000,000 Lbs. Capacity Dynamometer Car.

⅜ in. thick, with a 3½ in. by 3½ in. by ⅜ in. angle at the top, and two 3½ in. by 3½ in. by ½ in. angles at the bottom; there is also a ⅜ in. top cover plate the full length of the car. A ¼ in. steel plate covers the entire floor from the end sill to the inner edge of the body bolster at the dynamometer end. The body bolster is en-



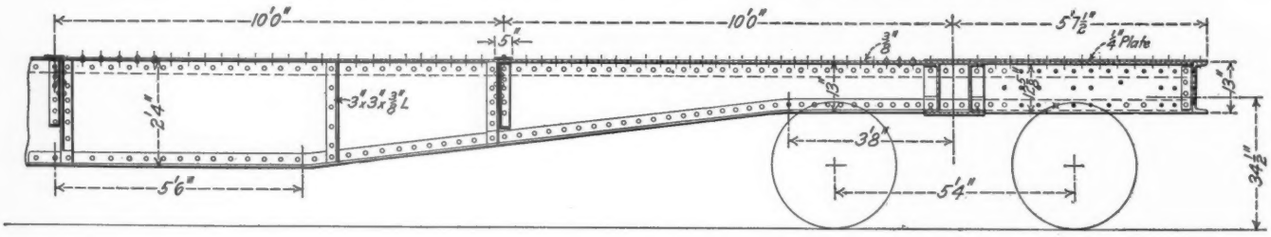
Dynamometer Car of 1,000,000 Lbs. Capacity; Atchison, Topeka & Santa Fe.

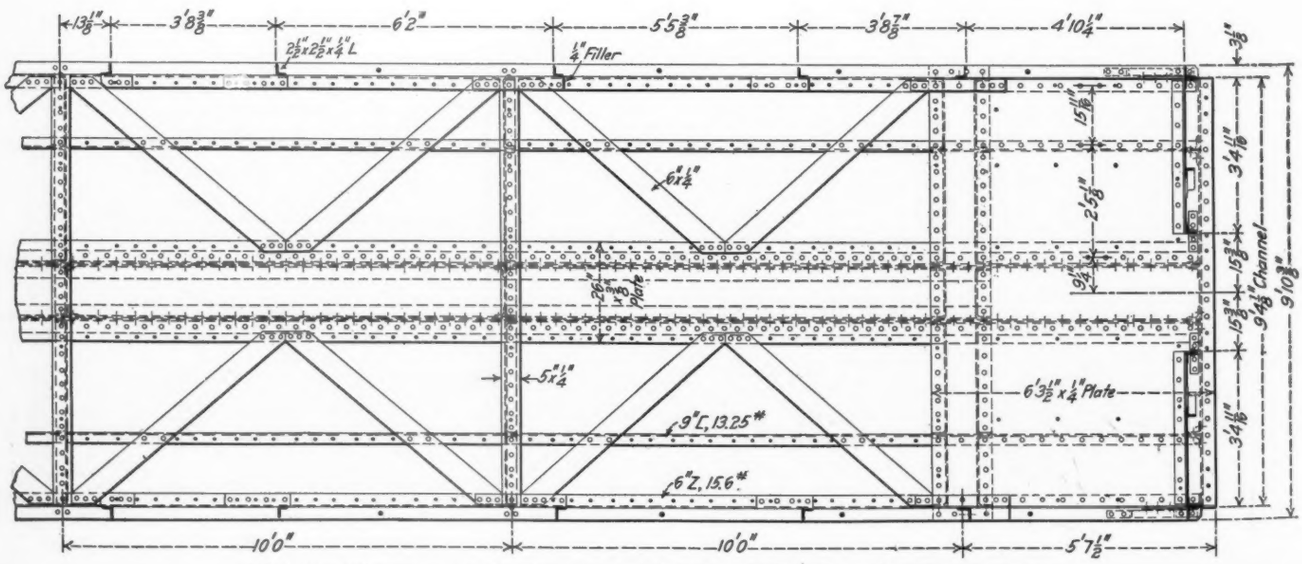




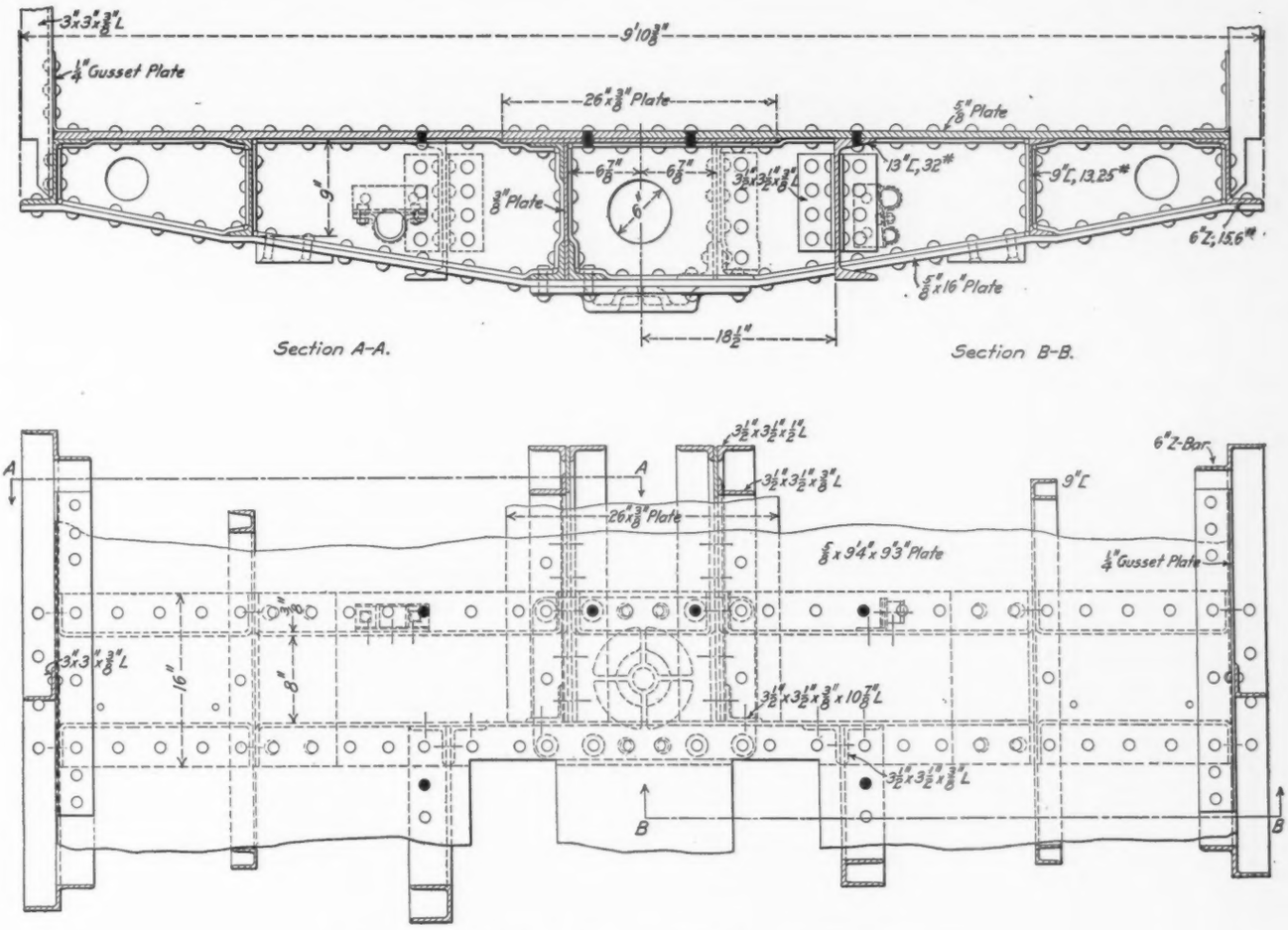
Crosstie At Dynamometer End Looking Towards Center of Car.
Crosstie Opposite Dynamometer End Looking Towards Center of Car.

Sections Through Underframe of Dynamometer Car Showing Arrangement of Crossties.

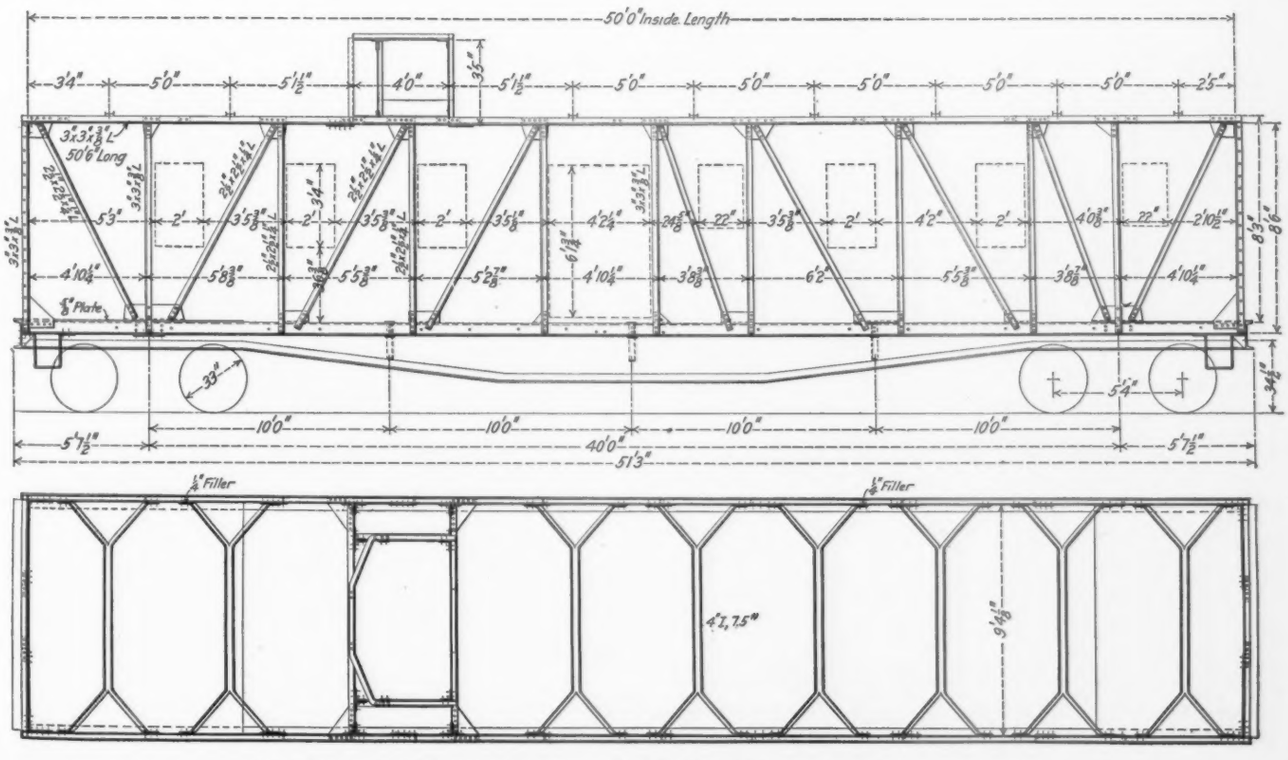




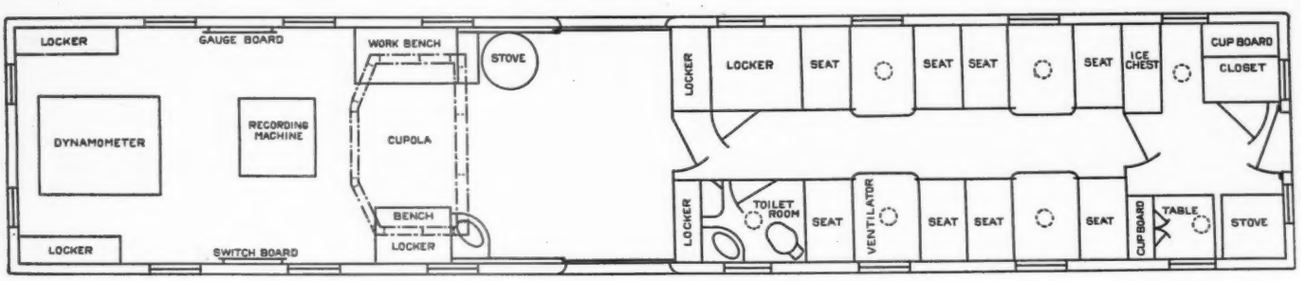
Steel Underframe of Santa Fe Dynamometer Car at End Opposite Dynamometer.



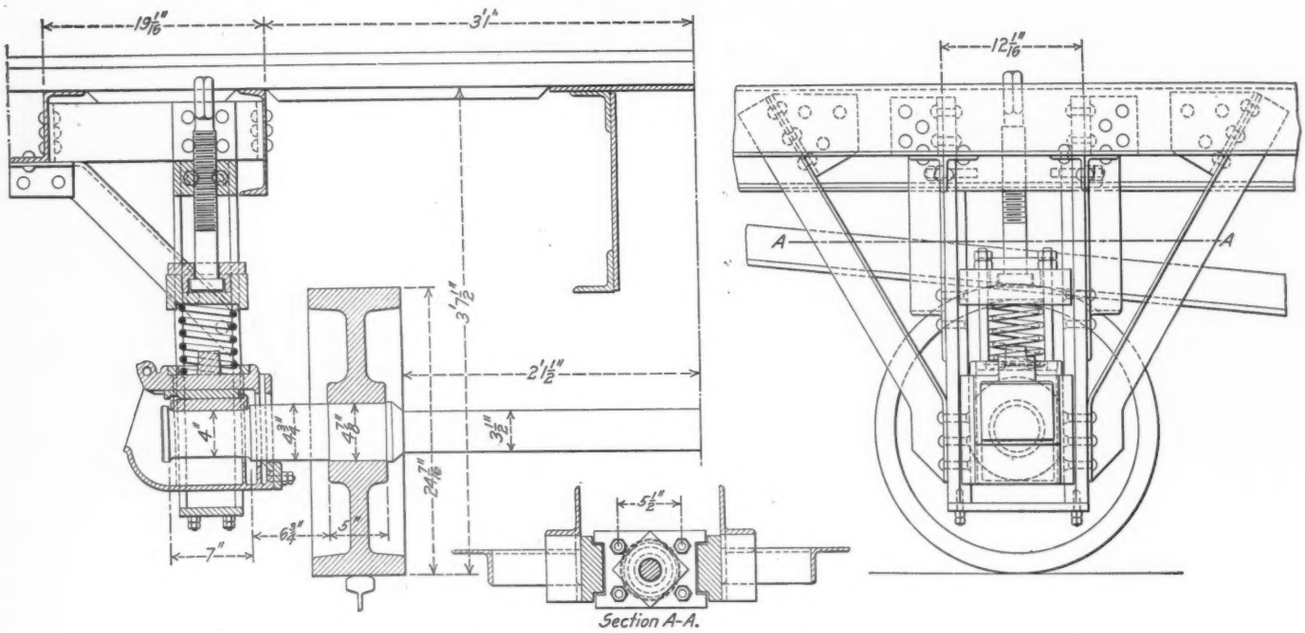
Body Bolster at Dynamometer End of Santa Fe Dynamometer Car.



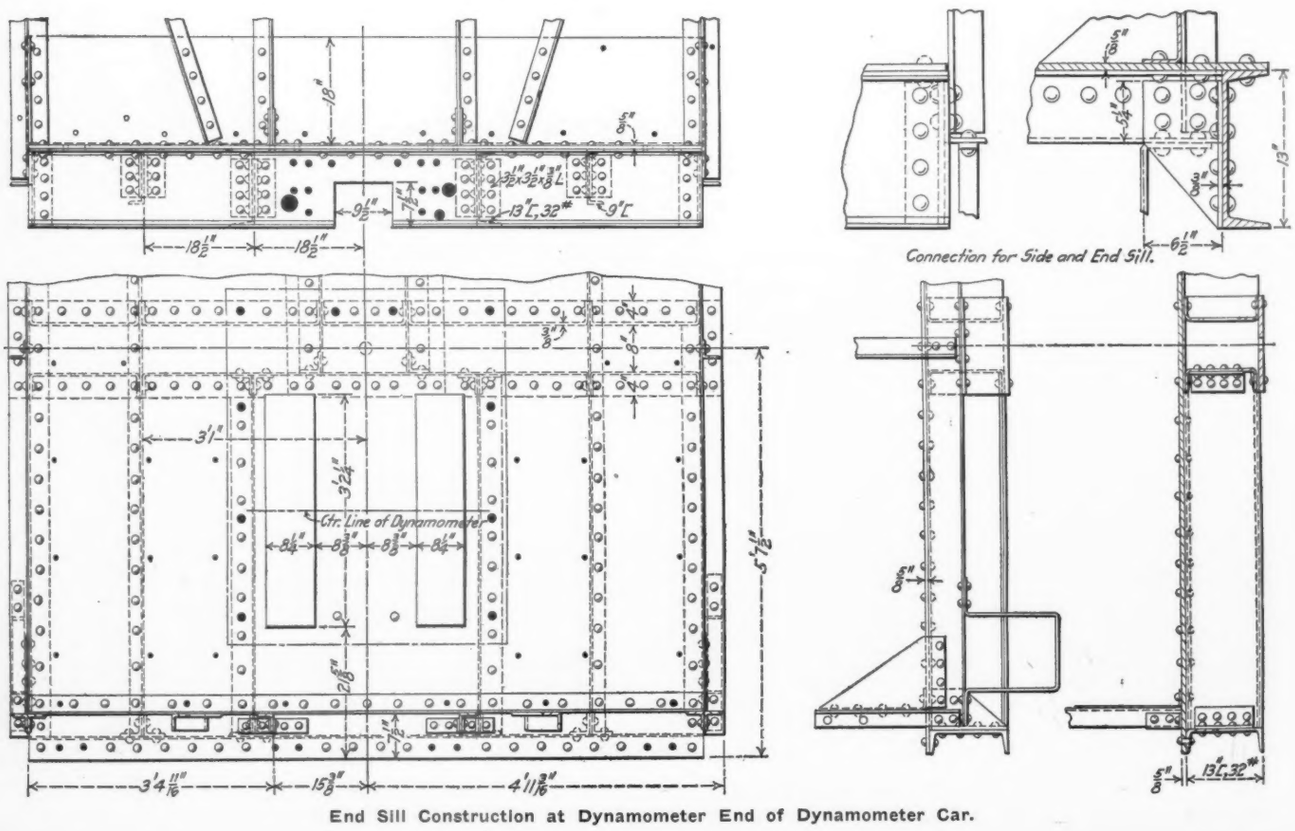
Steel Side and Roof Frame of Santa Fe 1,000,000 Lbs. Capacity Dynamometer Car.



Floor Plan of the Santa Fe Dynamometer Car.



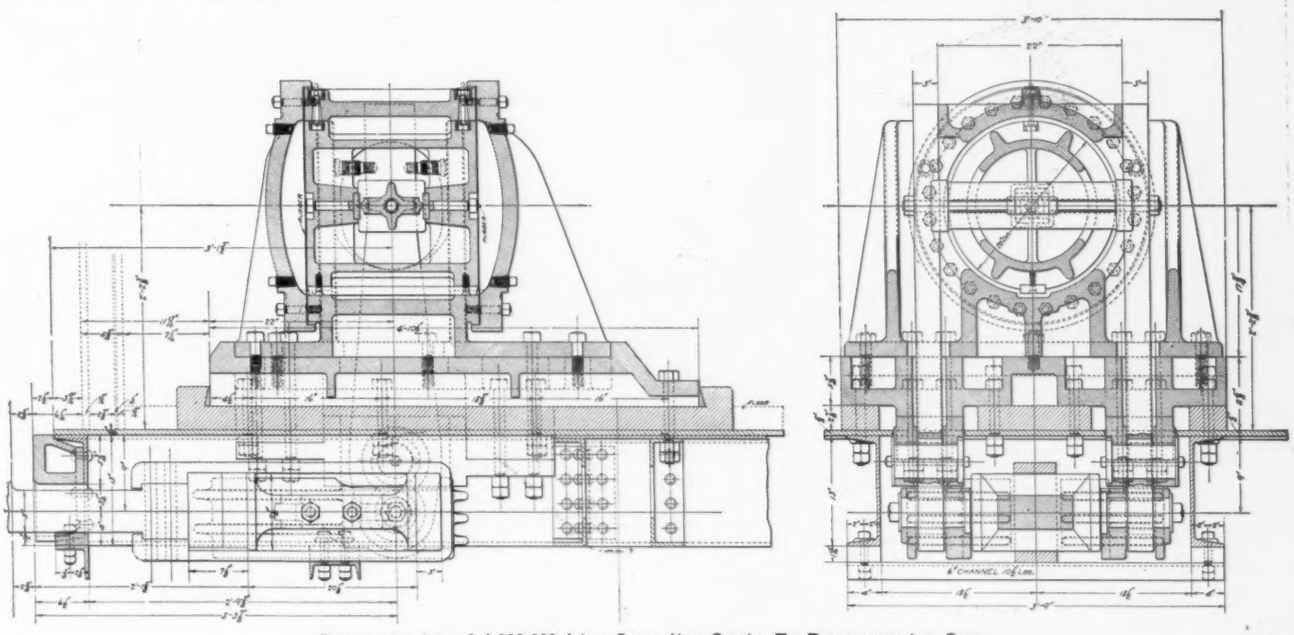
Auxiliary Truck; Santa Fe Dynamometer Car.



End Sill Construction at Dynamometer End of Dynamometer Car.

tirely of rolled and flanged steel parts with 5/8 in. by 16 in. top and bottom plates, and two 3/8 in. webs spaced 8 in. apart. The end sill is a 13 in., 32 lb., channel. The crossties have 5 in. by 1/4 in. top and bottom plates with single flanged webs 3/8 in. thick. The posts, braces and plates in the side and end framing are steel angles with the dimensions shown on the general plan. The carlines are 4 in. I-beams split near the end, so as to form diagonal bracing at the plate.

A 3/8-in. steel plate covers the front end of the car for a height of 2 ft. from the floor. The length over end sills is 50 ft., and the extreme width is 10 ft. The working end of the car is 25 ft. in length, and contains the dynamometer, recording apparatus, switchboard, gage board, work benches, stove and desk. The rear half of the car contains four upper and lower berths, toilet room, closet and kitchen. The trucks are of the four-wheel arch bar type, with heavy elliptical springs and extra heavy arch bars. The wheels are 34 in. in diameter and have steel tires. The car is lighted by electricity from an axle lighting system, as will be explained later.



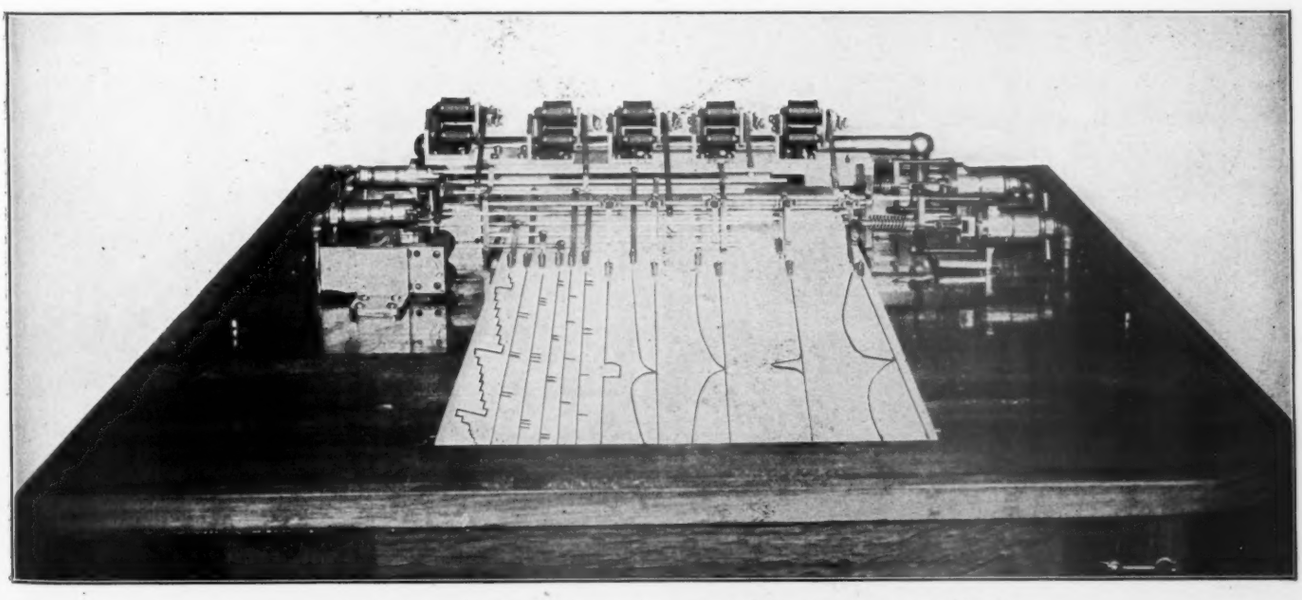
Dynamometer of 1,000,000 Lbs. Capacity; Santa Fe Dynamometer Car.

DYNAMOMETER.

The dynamometer is of the double diaphragm type, recording both drawbar pull and drawbar push. The lever arms, with a ratio of five to one, are connected at one end to a filler block in the drawbar yoke and at the other end to a double piston, 20 in. in diameter, whose heads press against blind rubber gaskets, covering the liquid chambers. The piston is suspended by means of knife edges, in order to eliminate all friction. The bearings for the lever arms are small hardened tool steel pins surrounding the main pins. A mixture of glycerine and alcohol is used in the liquid chambers. These latter are connected to the recording apparatus and gage board by 3/4-in. copper pipes. When the dynamometer is not in use the arms are brought to the center and held by four small jacks between the top of the arms and the cylinder casting. The dynamometer is so designed as to take and record safely a shock of 1,000,000 lbs. at the drawbar.

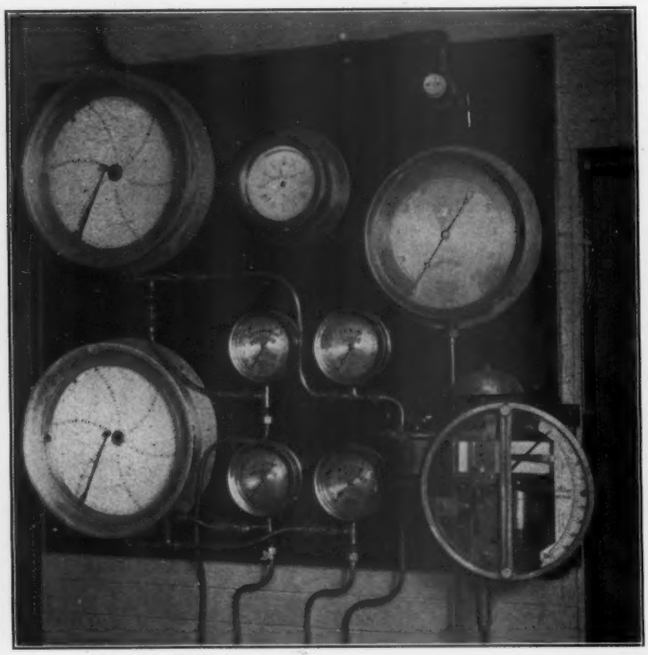
RECORDING APPARATUS.

The recording apparatus is placed just back of the dynamometer and the following records may be made on the chart:



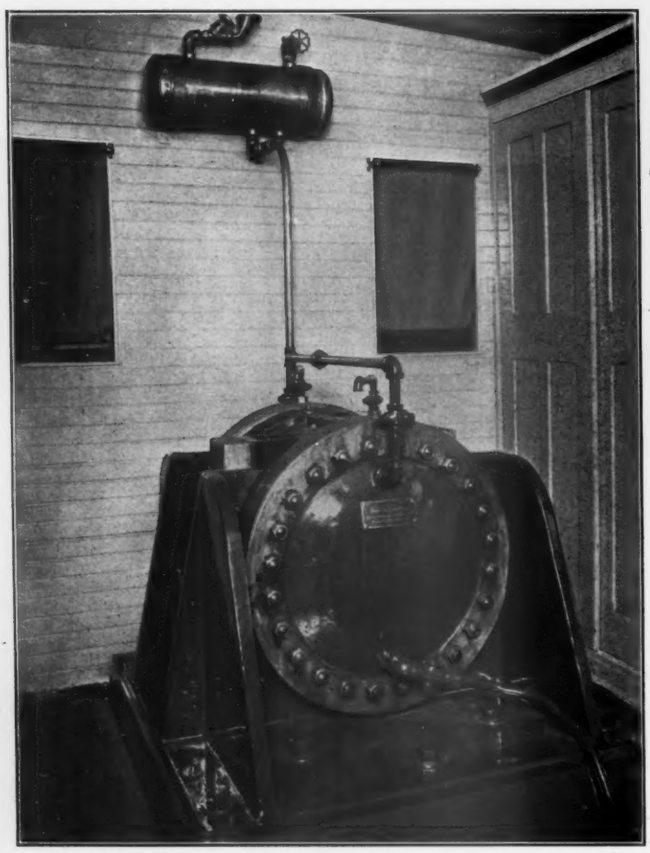
Recording Apparatus in Dynamometer Car Showing the Pens and Charts.

Drawbar pull; drawbar push; speed; time either by five seconds or half-seconds; position of mile posts and stations; throttle opening; reverse lever; boiler pressures; indicator cards; train line pressure; brake cylinder pressure, and coal or oil fired. The



Gage Board in Dynamometer Car.

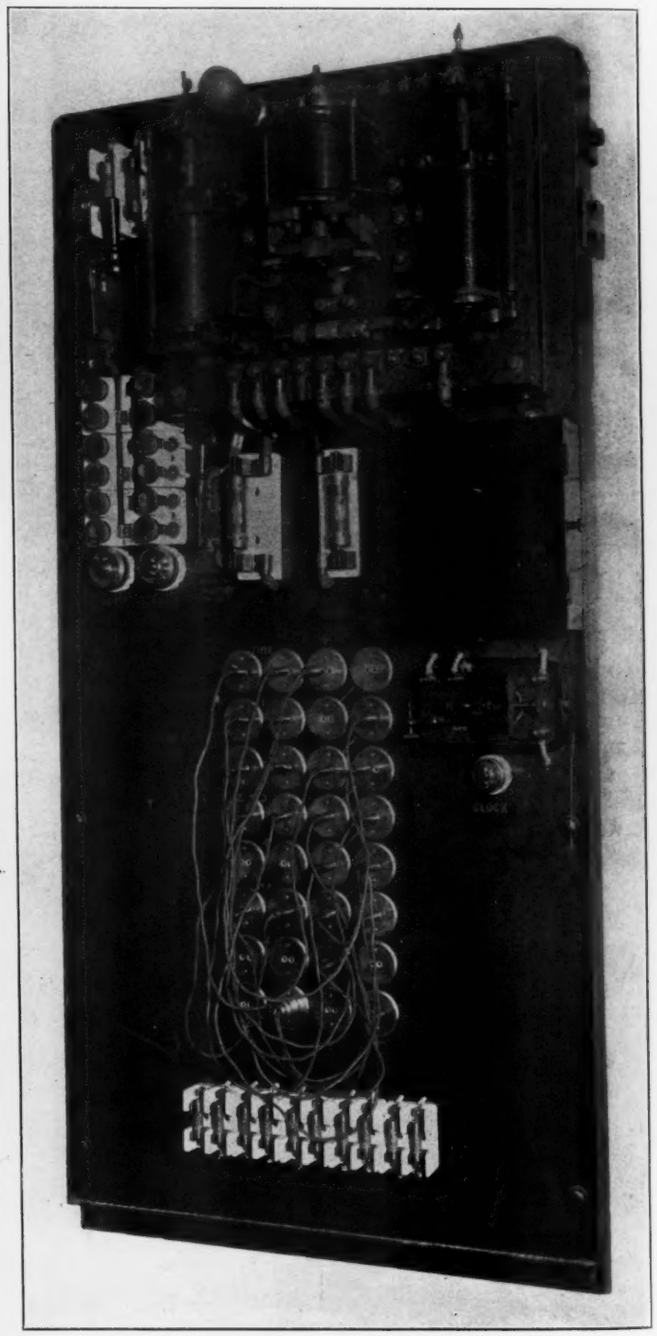
recording apparatus is mounted on a very heavy iron base plate through which a driving shaft passes from the auxiliary truck below. The auxiliary truck has two 22-in. wheels with 9-in. plain tires. It is connected to the main driving shaft through a



The Dynamometer.

train of bevel gears, which run in oil, by a universal joint. This auxiliary truck may be raised or lowered from within the car.

An electric motor is also provided for driving the recording apparatus. Three speeds are provided for the motor drive and three for the auxiliary truck drive, it being the intention to use the auxiliary truck drive in rating work and general engine tests, and the motor drive in special air brake and draft rigging tests. By means of two conveniently located levers and clutches it is



Switchboard in Dynamometer Car.

possible to quickly change from one drive or one speed to another. The drive is so connected that reversal of direction of the car movement does not reverse the direction of chart travel. The records are made on a chart 15 in. wide, which is drawn over the table between two gear-connected rollers by friction. Both originating roll and receiving roll are located at the back of the machine, and can be readily removed or put in place.

All curves are drawn by pens attached to hollow aluminum rods running at right angles to the paper. All datum line pens are connected to a single cross bar at the front, their records being made an inch in front of those made by the recording pens. The pens are made of small brass cups with phosphor bronze troughs which carry a thread wick from the barrel to the point; they will draw a line moving sidewise as well as forward.

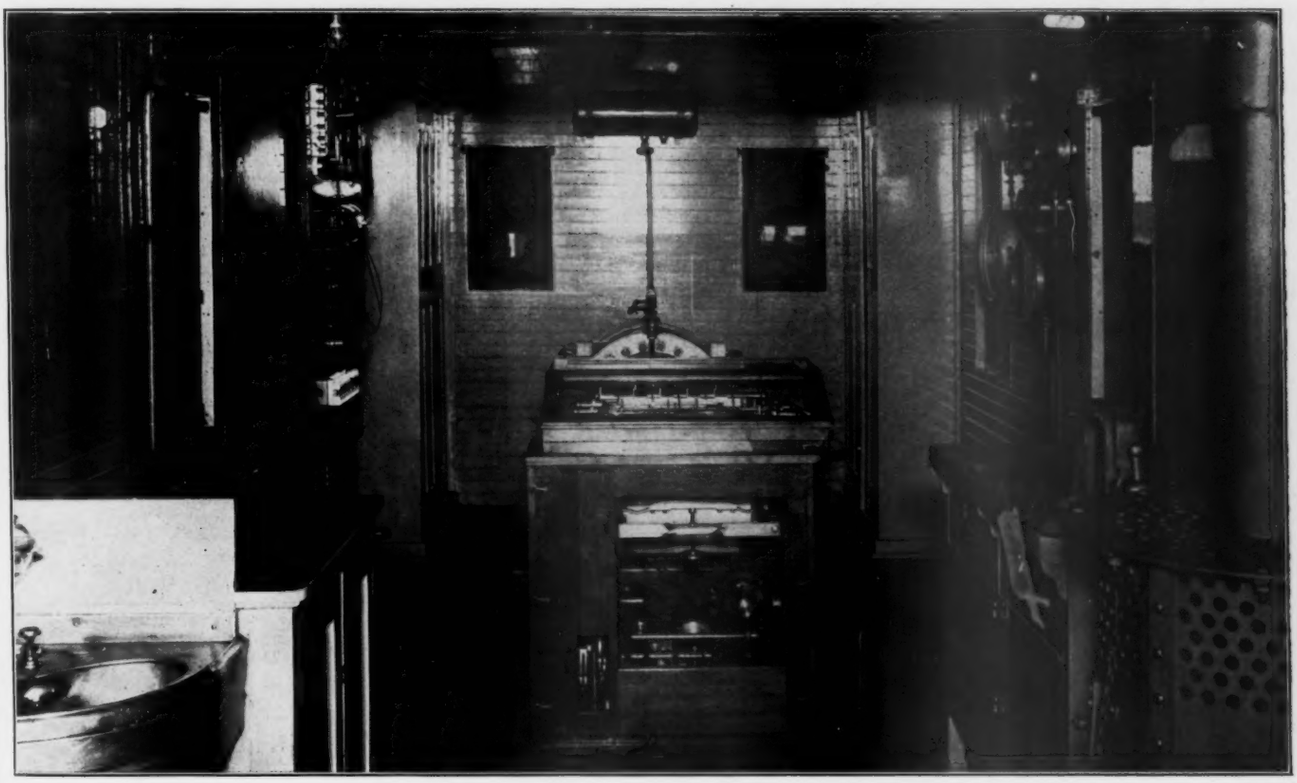
The pressures from the dynamometer are transmitted to standard outside spring Crosby indicators on one side of the recording table, it being the intention to put in different weights of indicator springs for the various classes of work. The curve of speed is obtained from a Boyer speed recorder located in the base of the recording apparatus and chain driven from the main shaft, it being so arranged that it may be driven at double its normal speed in freight service and at normal speed in passenger service, thus giving a large offset at low speeds when desired. The time record is drawn on one edge of the chart by means of a pen connected to a small electric magnet, which in turn is operated from an electric clock. Records of one minute, five seconds, or one-half second may be obtained. The record of locations is made by a small electric magnet in connection with a push button running to the observation cupola. The cupola is provided with an electric searchlight for night work.

The records from the locomotive are also made by means of electric magnets similar to that used in the location record. Two pens connected to standard Crosby indicators on the side of the table give a continuous curve of air pressure in the train line and in the brake cylinder, or if desired, in the auxiliary or supplementary reservoirs.

The gage board contains the following apparatus: One standard clock; one Haushalter speed recorder, driven from the main truck; four air recording gages; four standard air gages; one gage for the dynamometer showing drawbar pull, two electric counters.

ELECTRICAL EQUIPMENT.

Electricity for the lighting of the car and the operation of all magnets and motors is obtained from a set of 16 storage battery cells, located beneath the car. These in turn are charged by means of a Bliss generator, driven from the rear truck of the car. The voltage used throughout is 32. The switchboard is so arranged with a series of multiple jacks that it is possible to put any voltage on any magnet, thus making the whole arrangement flexible and convenient. The total weight of the car is 91,000 lbs. The outside is finished in standard Pullman color, and the interior in French gray.



Interior View of Dynamometer Car, Showing Recording and Other Apparatus.

LUBRICATION AND SUPERHEATED STEAM

Oil for use with superheated steam is discussed in an article in a recent issue of *Revue Industrielle*, in which the author says that the flash point is an important point to be determined for such oils. As a general thing it may be taken that the flash point for oils used in connection with saturated steam should be at least 20 per cent. above, and in the case of superheated steam at least 50 per cent. above, the temperature of the steam. For a number of years compounded oils have been used for this purpose. That is to say, oils to which about 5 per cent. of animal oil has been added. The use of this addition is of doubtful advantage, and in any event, the percentage used should not be more than 5, because of the corrosion that is apt to be set up by the liberation of the acids. While the flash point may be taken in an open vessel, the use of the closed Pensky-Martens apparatus is recommended as preferable.

The acidity should not exceed an average of 0.3 per cent., calculated in sulphuric acid, for clear oils, and .15 per cent. for the dark oils. A practical test for the oil is suggested as follows: Let a few drops fall on the surface of a carefully polished plate of copper or brass, and set the plate aside for about eight days, taking the precaution to shield it from dust. If, at the end of that time, the oil takes on a clear green color, or distinctly shows a clear green precipitate, the conclusion may be safely reached that there is acid present in the oil and that it should be rejected.

SHOP KINKS

BY C. J. DRURY,
Master Mechanic, Eastern Railway of New Mexico, Amarillo, Tex.

FLUE SWEDGING MACHINE.

The flue swedging machine shown in Fig. 1 is made from an old brake cylinder with two 1¼ in. holes drilled in its sides 5¼

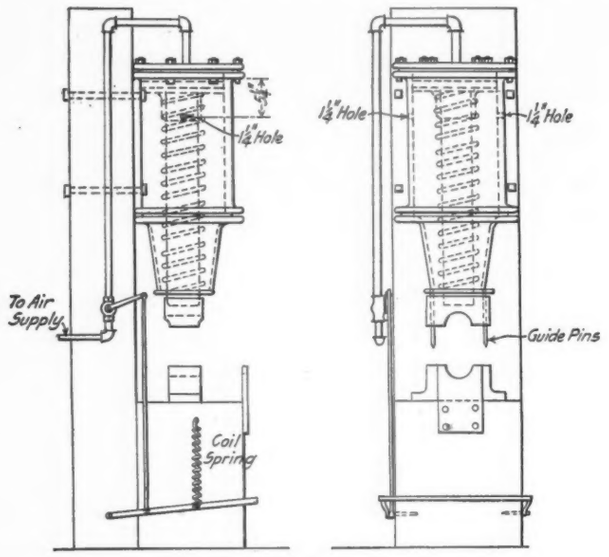


Fig. 1—Flue Swedging Machine.

in. below the top. The cylinder is fastened to a post as shown, and has a die fitted on the end of the piston rod. This die has

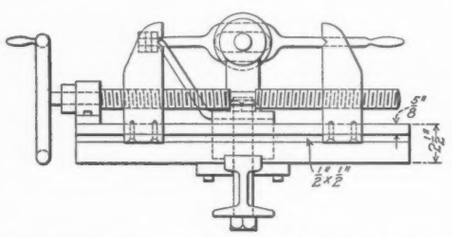


Fig. 4—End View of Bolt Centering Machine.

guide pins which fit in holes in the bottom die, thus keeping the dies in alignment. Air enters at the top of the cylinder and the supply is controlled by a foot lever which operates a valve. The machine will operate continuously while the air valve remains open, for, after the piston passes the exhaust holes, the pressure

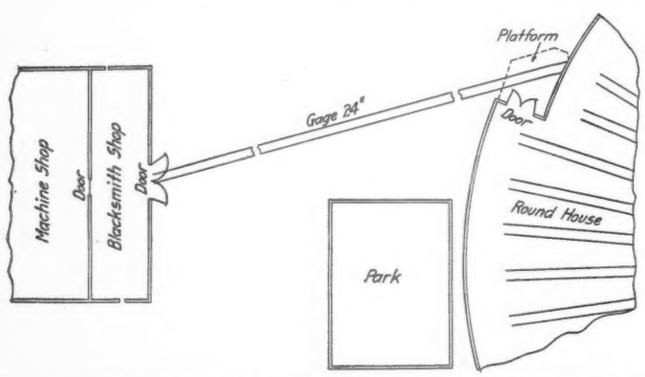


Fig. 2—Delivery Track Between Engine House and Machine Shop.

on it is relieved and the piston is forced back by the compressed spring. The machine can be made from scrap material for $5.

ENGINE HOUSE TRUCKING SYSTEM.

The arrangement for carting the engine parts to be repaired from the engine house to the shops is shown in Figs. 2 and 3. A 24-in. gage track runs from a platform just inside the engine house door to the blacksmith and machine shops. The truck shown in Fig. 3 is used on this track. It has a platform 4 ft.

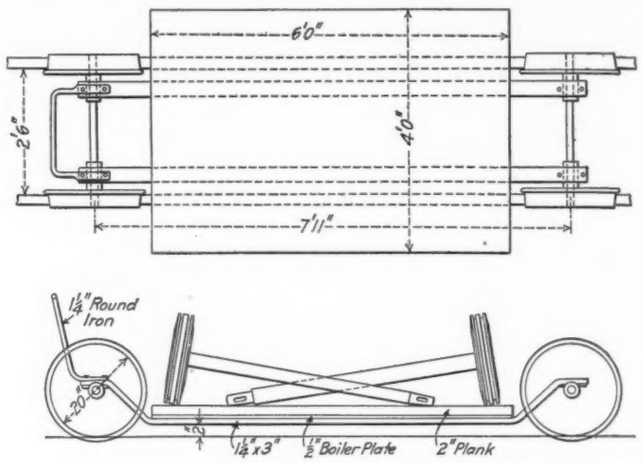


Fig. 3—Car Used for Handling Material Between Engine House and Shops.

wide by 6 ft. long, the top of which is only 5¾ in. above the rail, making it convenient for loading heavy material. The truck has a wheel base of 7 ft. 11 in. with 20-in. wheels, and the frame consists of two 1¼ in. x 3 in. iron bars connecting the two axles. A handle of 1¼ in. round iron is used to push the truck.

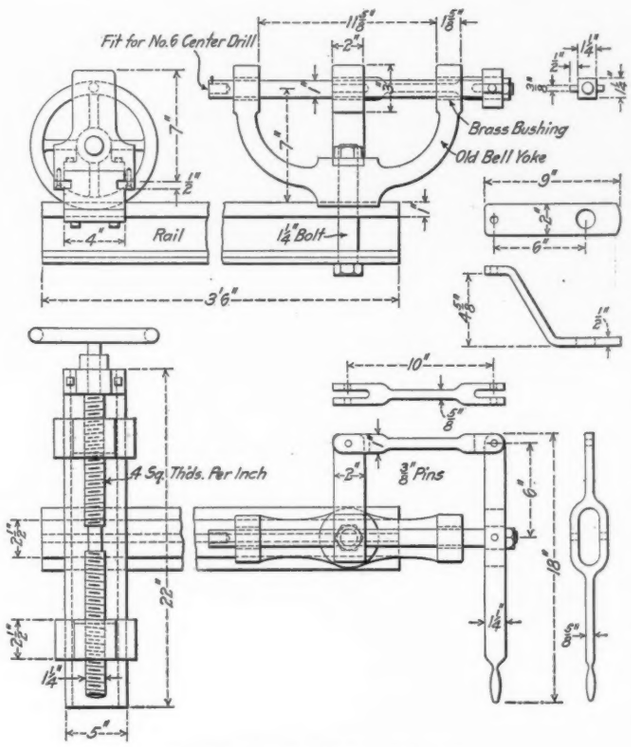


Fig. 4—Bolt Centering Machine.

BOLT CENTERING MACHINE.

In small shops that have no up-to-date machine for centering bolts, the device shown in Fig. 4 can be made and will give very satisfactory results. It consists of an old bell yoke fastened to a rail 3½ ft. long, a transverse table for the chuck being at-

tached at the other end. The bell yoke is bolted to the rail by a 1¼-in. bolt and has a one inch spindle extending through the holes in the arms. This spindle has a 3 in. pulley fixed in the middle, and is given longitudinal motion by the system of levers shown, the drill being fitted in the end of the spindle as indicated in the illustration. The chucking table is made of a block 4 in. wide which is fastened across the end of the rail by four bolts. This block has slots which guide the two jaws that slide on its top. These jaws operate on a lead screw having right and left-hand square threads, which keeps them always at the same distance each side of the center. They are operated by a hand wheel, as shown. This arrangement can be easily made

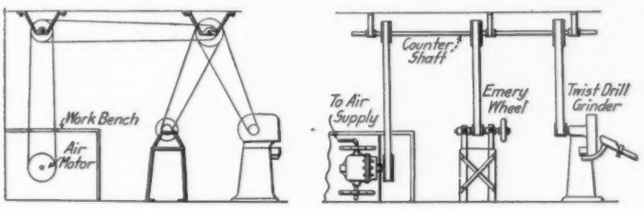


Fig. 5—Pneumatic Drive for Tool Room.

from scrap material at a cost of $10, and will serve its purpose almost as well as any other bolt-centering machine.

PNEUMATIC DRIVE FOR TOOL ROOM.

In many shops the tool room is in such a location, especially at small plants, that it is inconvenient to reach it with the line shaft from the shop engine. Such is the case in our shop, and it was found necessary to rig up an air motor drive, as shown in Fig. 5. The motor was boxed in so as to muffle the noise and keep out the dust. It will be noticed that it drives two emery wheels. The motor and the emery wheel stands were installed at a cost of about $15 and the arrangement adds greatly to the efficiency of the tool room.

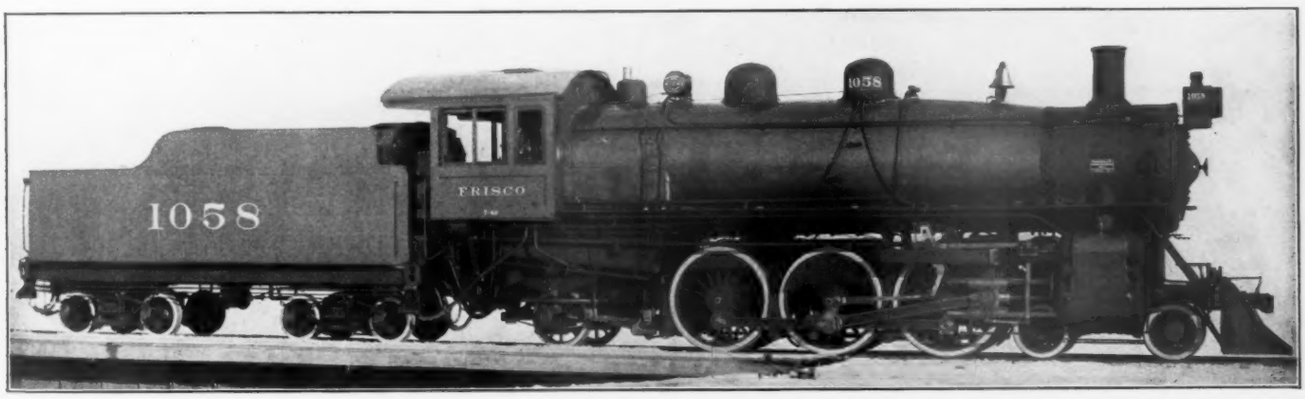
Coin Operated Speed Indicator.—There has been designed in England an arrangement whereby a passenger on the train who is curious concerning the speed at which he is riding can, by inserting a coin and pressing a button, have his curiosity gratified. This idea was conceived by H. Weymouth Prance and consists of a speed indicator belted to the axle through the medium of a clutch. Normally the speed indicator is out of action, but when a coin is inserted in the machine, it releases a latch and permits the clutch to be engaged when the button is pressed. In this way the indicator is started through the medium of the belt, there being an automatic arrangement for taking up the slack and preventing slipping, and the speed of the train is shown on a dial in the car. When the button is released a spring disengages the clutch and it is locked in this position by the latch, requiring the weight of a coin to again release it.

POWERFUL PACIFIC TYPE LOCOMOTIVE

A theoretical tractive effort 1,000 lbs. greater at 50 miles per hour than the average at that speed for other locomotives of the same type and of approximately the same weight, is a feature worthy of particular notice. This combined, with an ample boiler capacity to deliver its calculated cylinder power at that speed makes the design of the Pacific type locomotive built by the American Locomotive Company for the Frisco Lines deserving of careful study. A comparison of the tractive effort at various speeds, from starting up to 50 miles per hour, of this locomotive and the average of five other representative Pacific type locomotives of recent construction and about the same total weight is given in the following table:

Speed, M. P. H.	Theoretical tractive efforts. (A. L. Co.'s formulæ.) St. Louis and San Francisco.	Average of 5 Pacifics of approximately same weight.	Difference in tractive effort in favor of Frisco. Pounds.	Per Cent.
Starting.....	40,800	34,140	6,660	19.5
30.....	24,760	22,670	2,090	9.2
35.....	21,210	19,540	1,660	8.6
40.....	18,560	17,110	1,450	8.4
45.....	16,440	15,200	1,240	8.1
50.....	14,660	13,650	1,010	7.4

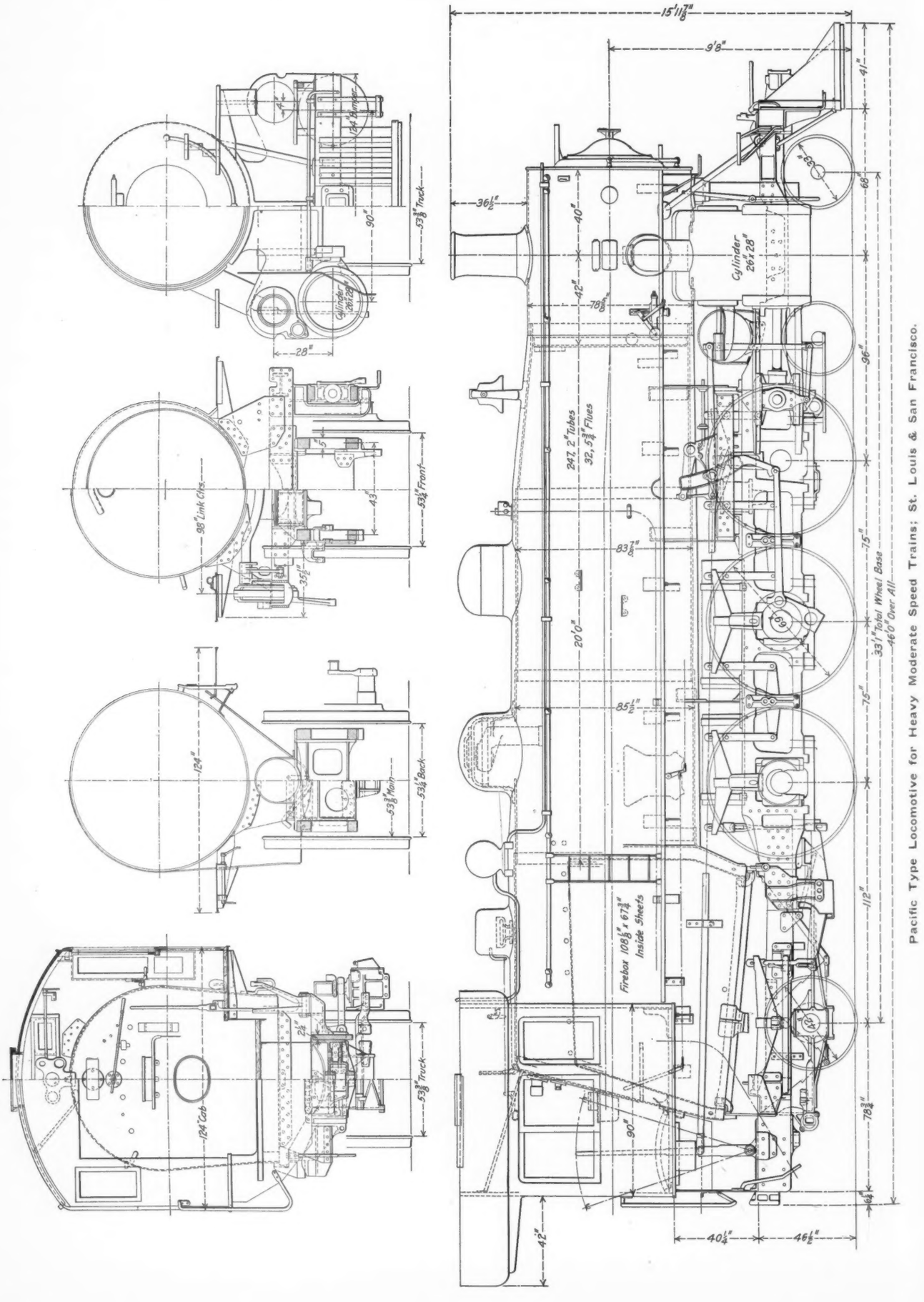
These tractive efforts are calculated in accordance with the adopted practice of the builders which employs speed factors based on the piston speed corresponding to the speed in miles per hour. The average weight of the five locomotives is 255,500 lbs., as compared with 260,500 lbs. for the Frisco. The lightest weighed 9,000 lbs. less than the Frisco, and the heaviest 1,500 lbs. more. Of the five, three use superheated steam. The tractive efforts given may therefore be considered conservative, as the speed factors used apply particularly to locomotives using saturated steam. From recent tests they appear to be somewhat low for locomotives equipped with fire tube superheaters.



Pacific Type Superheater Locomotive of Exceptional Power at Moderate Speeds.

With its 69-in. drivers, the Frisco locomotives would not seem to be particularly well adapted to some classes of modern fast passenger service in which speeds of 60 miles an hour and over obtain, but within the range of speeds covered in the table the comparison indicates a well balanced design, carefully worked out. With its large tractive effort at speeds of 40 and 45 miles per hour it would seem to be also well adapted to fast freight service on moderate grades.

Twenty of these engines have recently been delivered by the builders to the St. Louis & San Francisco, being built entirely to the railway company's specifications. There are included a number of new features first introduced into locomotive practice in this country by the American Locomotive Company, and which are being quite extensively adopted and specified by the various roads throughout the country. Among these will be noticed the outside steam pipes, the self-centering guide for the valve stem and the outside bearing radial truck with floating yoke spring guide and universal flexible spring supports.



Pacific Type Locomotive for Heavy Moderate Speed Trains; St. Louis & San Francisco.

The boiler is of the extended wagon top type with a minimum diameter of 75⅝ in., and a maximum diameter of 85½ in. It provides a total heating surface of 3,676 sq. ft., with a superheating surface of 758.6 sq. ft. Assuming that the locomotive will deliver a tractive effort of 14,660 lbs. at 50 miles per hour, as shown in the above table, this would be equivalent to an indicated horse power of 1,950. At a rate of steam consumption of 21.6 lbs. per indicated horse power per hour, a conservative average figure for a superheater engine, even when not worked to its capacity, and including steam used in cylinders and air pumps and losses through safety valves, this would mean a water evaporation of 42,206 lbs., or 11.4 lbs. per sq. ft. of heating surface per hour. Except with a poor grade of coal, the boiler should be able to maintain this rate of evaporation at 175 lbs. boiler pressure without the least difficulty. Assuming a fuel consumption of 3¼ lbs. per indicated horse power per hour, the rate of combustion required to maintain the above capacity would be 122 lbs. of coal per sq. ft. of grate area per hour.

The general dimensions, weights and ratios are given in the following table:

General Data.

Gage	4 ft. 8½ in.
Service	Passenger
Fuel	Bit. coal
Tractive effort	40,800 lbs.
Weight in working order	260,500 lbs.
Weight on drivers	158,000 lbs.
Weight of engine and tender in working order	421,700 lbs.
Wheel base, driving	12 ft. 6 in.
Wheel base, total	33 ft. 1 in.
Wheel base, engine and tender	64 ft. 9 in.

Ratios.

Weight on drivers ÷ tractive effort	3.87
Total weight ÷ tractive effort	6.40
Tractive effort × diam. drivers ÷ heating surface*	585.00
Total heating surface* ÷ grate area	94.60
Firebox heating surface ÷ total heating surface*, per cent	4.23
Weight on drivers ÷ total heating surface*	32.70
Total weight ÷ total heating surface*	54.10
Volume both cylinders, cu. ft	17.30
Total heating surface* ÷ vol. cylinders	279.00
Grate area ÷ vol. cylinders	2.93

Cylinders.

Kind	Simple
Diameter and stroke	26 x 28 in.

Valves.

Kind	Piston
Greatest travel	6 in.
Outside lap	1 in.
Inside clearance	0 in.
Lead at 85 per cent. cut off or more	3/16 in.

Wheels.

Driving, diameter over tire	69 in.
Driving, thickness of tires	3½ in.
Driving journals, diameter and length	10½ x 13½ in.
Engine truck wheels, diameter	33 in.
Engine truck journals	6½ x 12 in.
Trailing truck wheels, diameter	42 in.
Trailing truck journals	8½ x 14 in

Boiler.

Style	E. W. T.
Working pressure	175 lbs.
Outside diameter of first ring	74 in.
Firebox, length and width	108 x 68½ in.
Firebox plates, thickness	3/8 & ½ in.
Firebox, water space	4½ in.
Tubes, number and outside diameter	247-2 in.
Tubes, gage	No. 11 B. W. G.
Flues, number and diameter	32, 5⅜ in.
Flues, gage	No. 9, B. W. G.
Tubes, length	20 ft.
Heating surface, tubes and flues	3,471.5 sq. ft.
Heating surface, firebox	204.28 sq. ft.
Heating surface, total	3,675.78 sq. ft.
Superheater heating surface	758.6 sq. ft.
Grate area	50.9 sq. ft.
Smoke stack diameter	18 in.
Smoke stack, height above rail	192 in.

Tender.

Wheels, diameter	33 in.
Journals, diameter and length	5½ x 10 in.
Water capacity	8,100 gals.
Coal capacity	14 tons

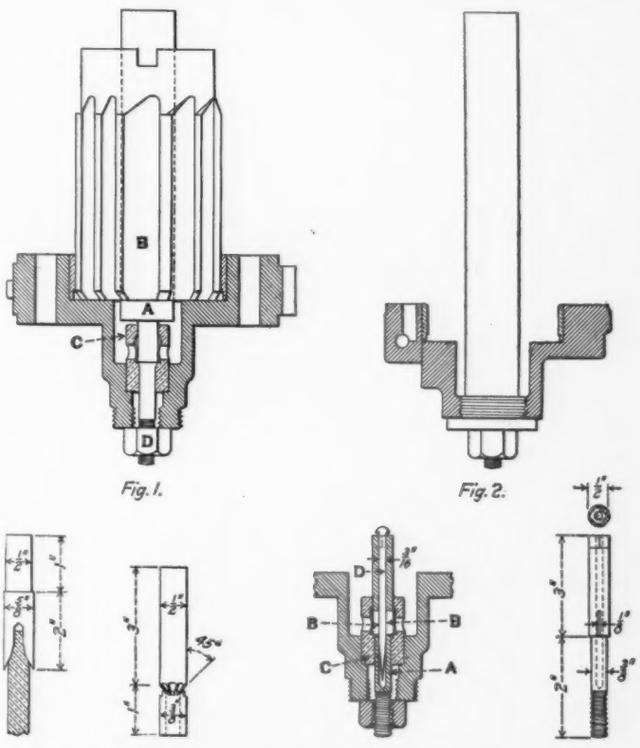
* Equivalent heating surface equals evaporating heating surface plus 1.5 times superheating surface.

Hydro-electric Plant.—A hydro-electric plant has been installed in the city of Santos, Brazil, which will utilize a 2,100-ft. head of water. Five 3,000-k.v.a. generators have been installed and will run at 514 r.p.m.

AIR BRAKE KINKS

BY J. A. JESSON
Air Brake Foreman, Louisville & Nashville, Corbin, Kentucky

Reboring the Equalizing Cylinder in Engineer's Valve.—For reboring the bushing in the equalizing cylinder of the engineer's valve to a different size a standard fluted shell reamer, with a 2½-in. straight arbor hole, may be used advantageously. It is held in position by a pilot bar, as shown in Fig. 1, which is held fast by a ⅜-in. nut, *D*. To merely true up the bushing a 3½-in. adjustable blade shell reamer can be used, the blades being ground with plenty of clearance. The reamer should first be dropped down to the bottom of the cylinder and the blades expanded by tapping the body of the reamer. A thin steel disc should be used under the blades when working on an H-6 valve. Fig. 2 shows a pilot bar fitted to the bottom cap thread of an A-1 valve. The pistons furnished with the H-6 valve, being a



Devices for Repairing Engineer's Valves.

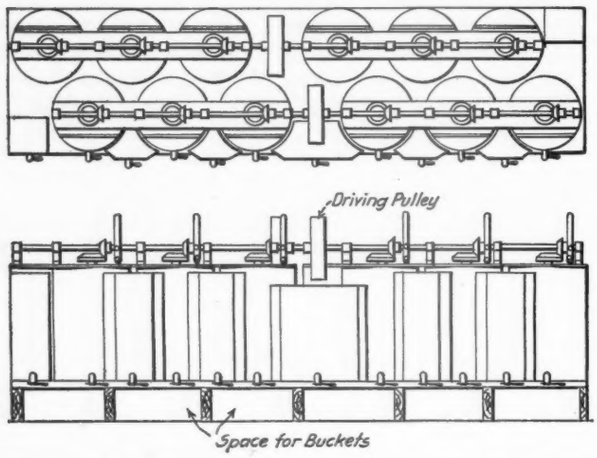
closer fit in the cylinder, can be used with the A-1 valve, thereby eliminating the necessity of reboring. These same operations are applicable to all styles of triple valves, the pilot bar being constructed to suit each case.

Repairing Discharge Valve Seat in Engineer's Valve.—A milling tool, or female reamer, is shown in Fig. 3, fitting over the end of the valve stem on the end of the equalizing piston. It is ground to cut both the seat and the taper portion. Fig. 4 shows a male reamer for truing the valve seat in the bushing. An expanded counter-boring tool is shown in Figs. 5 and 6 in position tor boring out the valve seat bushing *C*. This is used for facing down the clearance around the valve seat when it becomes too deep. The blades *B* of the tool are extended and released by lowering and raising the pin *D*, and the tool is fed by the nut at the bottom. When placing this tool in position the blades will close in while passing through the upper end of the bushing *C*. The threaded end of the tool should be omitted when making it for an A-1 valve.

PAINT STOREROOM PRACTICE

BY O. P. WILKINS,
Foreman Painter, Norfolk & Western, Roanoke, Va.

It is generally conceded that to produce a thoroughly good and reliable paint it must be carefully ground and mixed. Realizing the importance of this last feature the Norfolk & Western installed some small machine-mixing cans, designed similar to the factory mixers at their Roanoke shops. The object was really two-fold; that of increasing the efficiency of the paint and to reduce the time lost by employees waiting to be served at the stock room counter. The old method of handling this



General Arrangement of Paint Mixing Tanks for Storeroom.

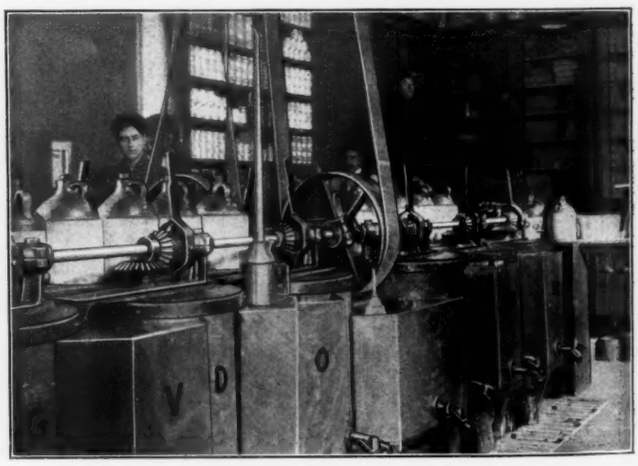
work was similar to that used in a large number of shops. All paints were mixed in pots, kegs or specially constructed cans with an ordinary spatula, and in most cases it was not mixed until the material was needed for the work at hand, and then it was done hurriedly on account of the work being performed on a piece-work basis. It was necessary for the men needing the material to wait at the counter, and if the job was of any size it would keep at least four men waiting, which would result in a loss of time ranging from 5 to 20 minutes for each man. This would not be so much for one gang, but in a shop where 30 to 40 men were employed on passenger car work, the time lost at the stock room counter was a serious question. The poor mixing was shown in some instances by the fact that a turpentine stain was frequently found at the top of the pot and the paste paint at the bottom. For the surfacers, truck color, floor color and roof paint a mixing can furnished by one of the varnish manufacturers was used. This can was provided with rod down through the center which held six blades and was operated with a handle on the outside of the can. This method of mixing was slow and uncertain.

The new method included 12 small mixing cans of about 25 gals. capacity each, which provides for the paints most frequently used on passenger car work. These mixers are motor-driven, connected by shaft, and can be operated separately or together. They are made of heavy sheet iron about ⅛ in. thick, and are fitted with a slide spigot at the bottom of the mixer. The mixers are placed on a platform of sufficient height to allow a pail 12 in. high to clear the spigots. The space underneath the platform is utilized for the purpose of storing the various paint pots used for the different kinds of paint. Paints that are used almost every hour during the day, such as floor color, roof color, tuscan body color, truck color, baggage wall color, different kinds of surfacer, etc., are carried in the mixers and are always ready to be drawn off and passed over the counter to the workmen at short notice.

The stock room attendant and his two assistants are required, along with their other duties, to keep these mixing cans in good condition and well filled with the proper materials. They report for duty 10 minutes in advance of the other workmen, in order to have everything in readiness, such as starting all the mixers, arranging the brushes, pots, etc., with the result that when the whistle blows everything is in shape to serve as called for, with the lease possible delay. By simply throwing the electric switch, 12 of the most important paints are thoroughly agitated and are made ready for use. The brushes for the various kinds of paints are near the mixing cans, being within easy reach of the attendants. For example: an attendant will receive an order for four "kits" of surfacer to be used on one or more cars; he immediately goes to the surfacer can where he will find four pots under the platform; he opens the spigot directly in front of him, fills the pots with sufficient material for the job and with brushes for this particular material right at hand he passes it over the counter to the four men almost in less time than it requires to tell of the transaction.

With twelve of these mixing cans in use containing the paints that are used almost every hour it is plain to be seen that little or no time is lost in serving the materials, because all the mixing is done simultaneously, thoroughly and uniformly before the paint is called for at the counter. In the space between these 12 mixing cans are fitted specially designed cans to hold the different varnishes, oils, etc., that do not require mixing. These are also drawn off through slide spigots, and each can holds approximately 20 gals. The details are so thoroughly carried out that either of the attendants could go into the room at night without the aid of artificial light and serve any of the mixed paints without making a mistake, if necessity so required. The mixing apparatus is located in the center of the room and near the serving counter.

The same general scheme is worked out in the paint stock house where nothing but bulk materials are handled. In this building are three large mixers holding approximately 125 gals. each; they are used for mixing freight car and building paints. These mixers are located on a specially constructed table or



Paint Storeroom Equipped with Belt Driven Mixers.

platform of sufficient height to allow the mixed paint to run from the mixer to the barrel in which it is to be shipped. A chain hoist is used to lift a barrel of the semi-paste paint to the top of these mixers where it is placed on a specially constructed trestle; the head is partially removed, and the paste is allowed to run into the mixer. The different thinners, such as linseed oil, reducing oils, turpentines, etc., are piped to each of these mixers from the storage tanks in the cellar from which they are forced by an air pressure of 5 lbs. per sq. in.

It is believed that this new system more than paid for itself during the first year of service by the time saved at the stock room counter and by the saving in materials. The cost of the complete equipment, including the motor was not more than

$450, and if it saved on an average ten minutes per man per day, 30 men at an average rate of 28 cents per hour, would effect a saving of $1.40 per day, or $420 in a year of 300 working days. This, however, does not take into consideration the saving in materials, the uniformity of the mixtures, or the high degree of proficiency, accomplished by machine mixing, each of which would add still more to the economy.

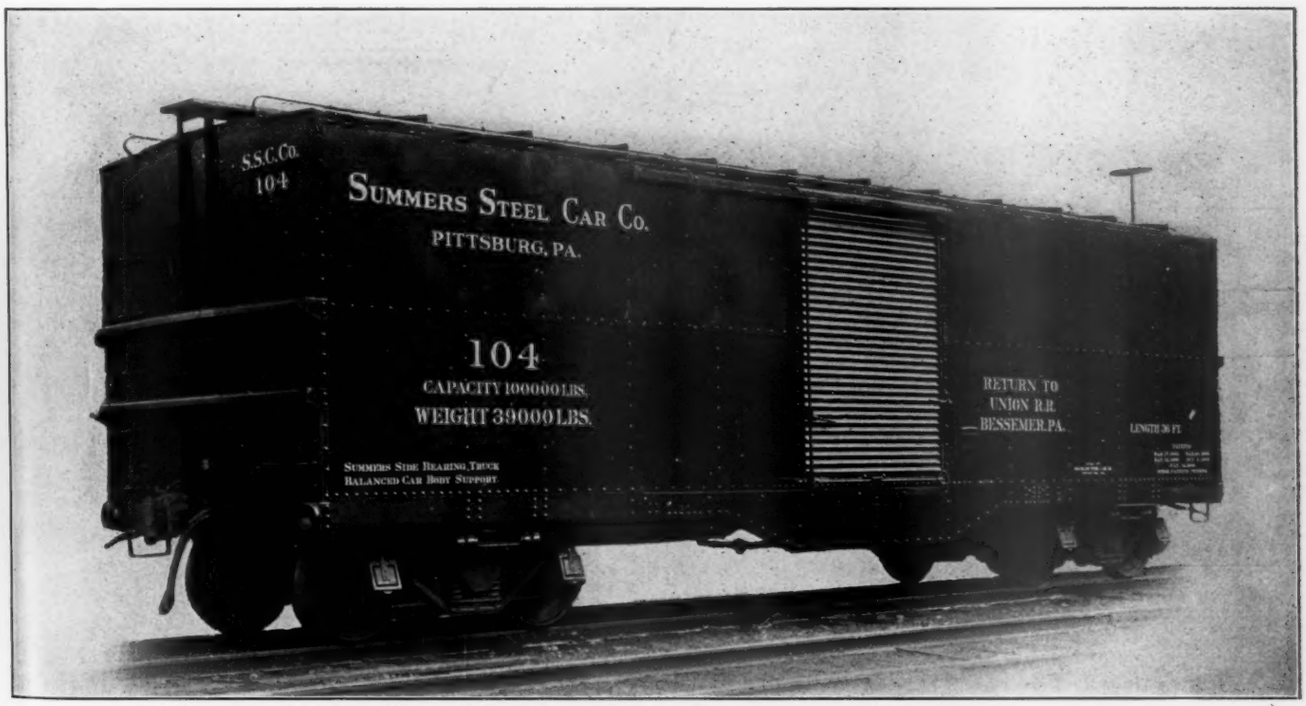
Another interesting feature in connection with this plant, and one worthy of special note, is that the cost of repairs during the entire five and one-half years' service has not exceeded $2. The accompanying illustrations show the general outline of the mixers, but the plant should be seen in operation to be fully appreciated. The main brush trays are placed against the wall opposite the mixing cans which would be at the right hand side looking at the photograph. These trays are similar to the three small trays seen at the end of the table. The large mixers in the stock house are not shown, but they are like the other mixers, although of larger capacity. The results obtained from them are consistent with those obtained from the small machines.

ALL-STEEL BOX CARS.

The first large order for all-steel box cars has just been awarded by the Bessemer & Lake Erie to the Summers Steel Car Company, Pittsburgh, Pa. A sample car of this type, built by the Summers Company, has been in service for the past two years, and the 100 fifty-ton cars which have just been ordered will conform to the sample car as far as the construction is concerned, except that they will be 4 ft. longer and the truck side frames will be of the regular arch bar type, but equipped with the Summers balanced side bearing features, the same as on the sample car. This balanced side bearing feature is a new and radical development in car truck construction and bids fair to come into general use because of enabling a car body of rigid construction to traverse twisted and rough track without throwing the twist into the car body or without danger of derailment. The construction of all-steel box cars is so rigid that without a truck of this kind it will be practically impossible to operate them safely. Refrigerator cars, tank cars, and other cars of similar construction are often derailed, apparently because of their rigidity in connection with the rigid center bearing truck and rough track. The new truck has a flexibility which permits the car to travel over very irregular track without distorting the car body and at the same time prevents the hammer blows, due to transverse rocking, which are so injurious to the equipment, the lading and the track.

The inside dimensions of the new cars will be 40 ft. long, 9 ft. wide and 8 ft. high. The car has no center sills, the entire vertical load being carried on the side girders. The lower member of the side girder, or what corresponds to the side sill in an ordinary car, is a 5/16 in. pressed steel angle which is deepened near the center of the car. The lower half of the side sheet is a 3/16 in. plate and the upper half is ⅛ in. thick. The lower half of the end sheet is ¼ in. thick and the upper half is ⅛ in. thick. The floor plates are ¼ in. and are supported by 10 in. channels, which extend from side to side of the car. The side sheets are stiffened on the inside by 3 in. x ¾ in. Z bars, weighing 6.7 lbs. per foot. The ends of the car are stiffened by the two horizontal pressed steel braces, the upper one of which covers the joint between the two halves of the end sheet.

The draft gear is attached to draft sills constructed of ⅜ in. plate pressed to a channel shape. Similar pressed members or diaphragms, but constructed of ¼ in. plate, extend between the cross beams above the center of the truck and just back of it. A bottom cover plate ⅜ in. thick extends underneath the rear end of the draft sills and for a distance of about 4 ft. toward the center of the car. The roof sheets are of Carnegie copper steel, ⅛ in. thick. The carlines are on the outside, leaving a smooth roof surface on the inside of the car. The construction is such that no rivets are driven through the roof plates to the inside of the car.

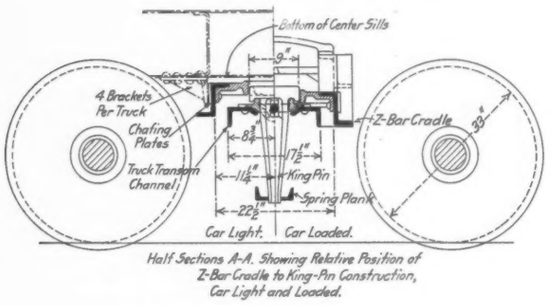


All-Steel Box Car Similar to Those Ordered by the Bessemer & Lake Erie, Although Not Quite as Long.

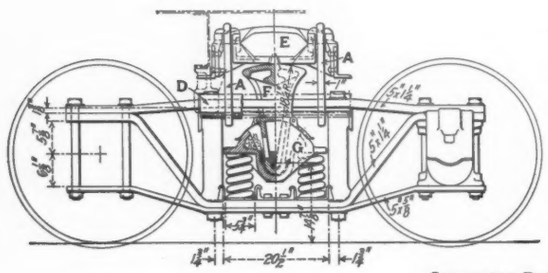
With this form of construction the car will weigh 43,000 lbs., or about 3,000 lbs. less than a steel underframe car of the same capacity and with the same inside dimensions. It is about 9 in. less in height at the eaves and the center of gravity is about 7 in. lower than for the steel underframe car. There are 12,000 lbs. more steel in the car and at the present prices of steel and lumber

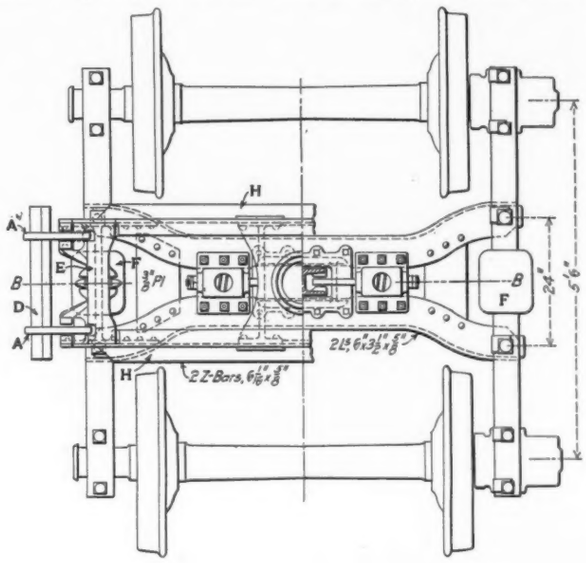
it can be sold in competition with the steel underframe type of car. It is expected that this order of 100 cars will demonstrate the practicability of the all-steel box cars. As shown on the cross section the car is lined with 13/16 in. yellow pine for a height of about 5 ft. Experience with the sample car thus far has demonstrated that no trouble is encountered due to moisture condensing on the inside of the car and thus damaging the lading. It is quite probable that the cars will be considerably warmer during hot weather than the wooden ones, but if this should be found objectionable it can possibly be overcome by lining or insulating the inside of the car.

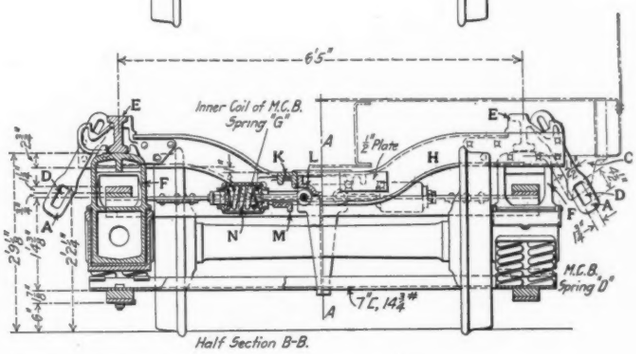
The truck arrangement is such that the whole load is carried on the inclined hangers at the side of the car, approximately the same as if it were suspended from a point at the intersection of the center line of the hangers extended until they meet above the center of gravity of the car; this arrangement permits the car



Half Sections A-A, Showing Relative Position of Z-Bar Cradle to King-Pin Construction, Car Light and Loaded.

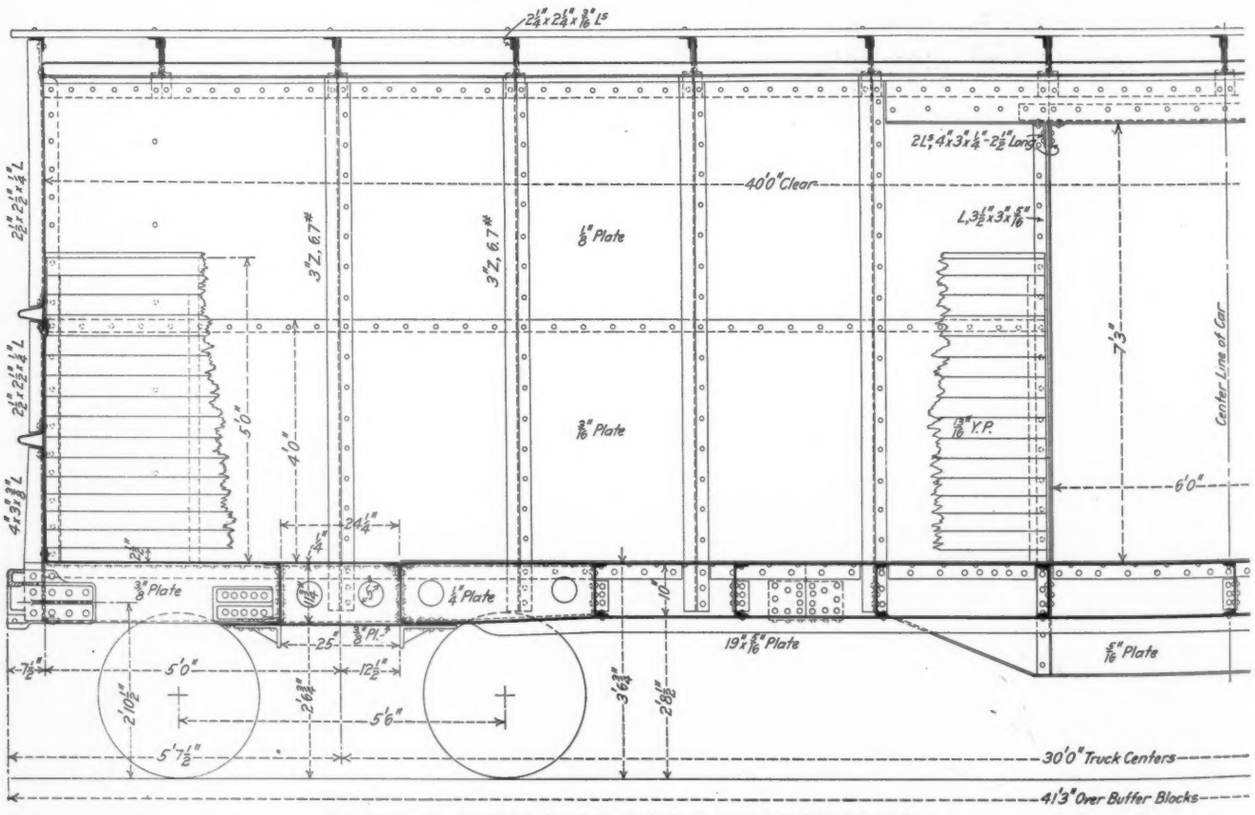




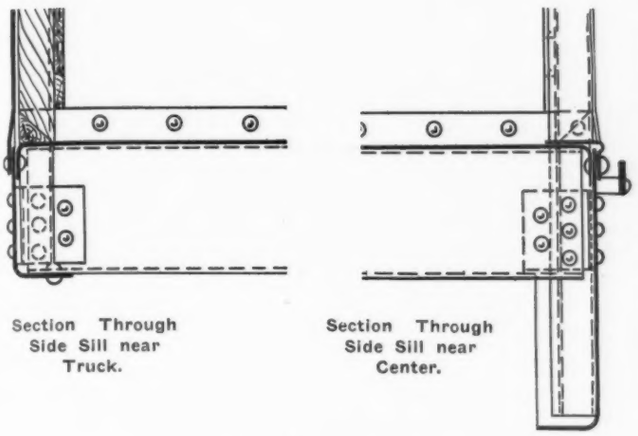


Half Section B-B.

Summers Balanced Side Bearing Truck.



Part Longitudinal Section Through Summers All-Steel Box Car.

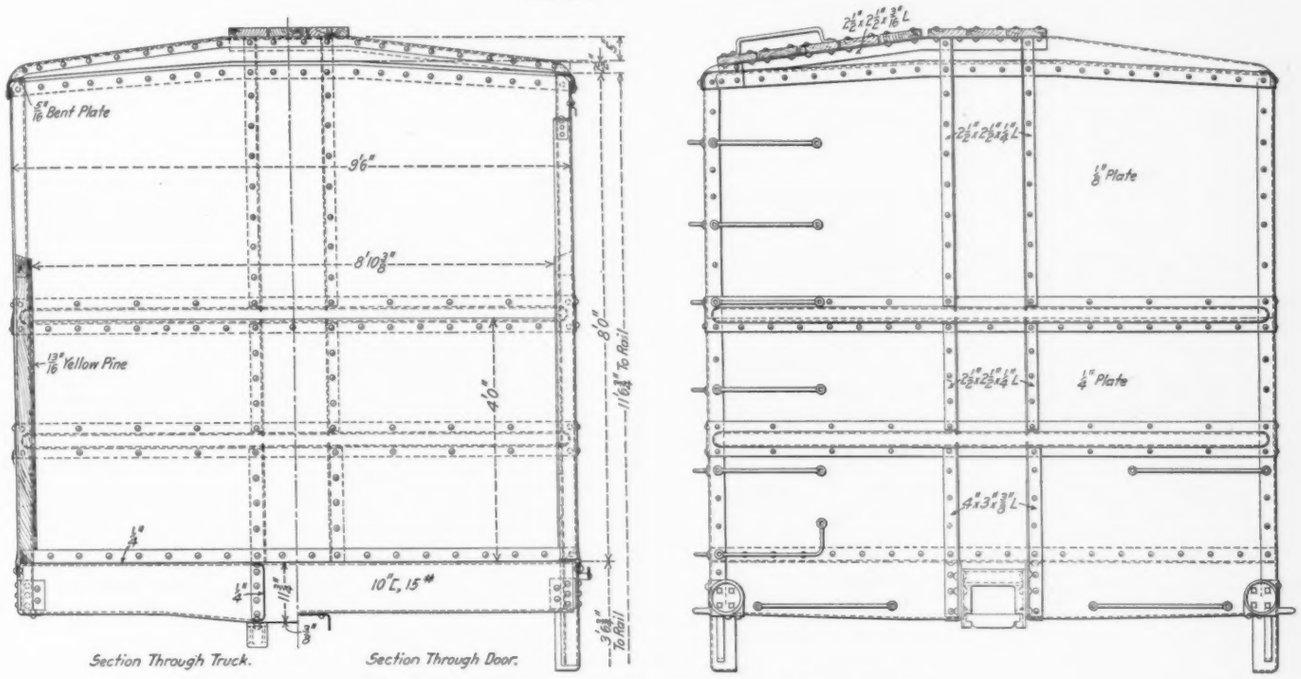


Section Through Side Sill near Truck.

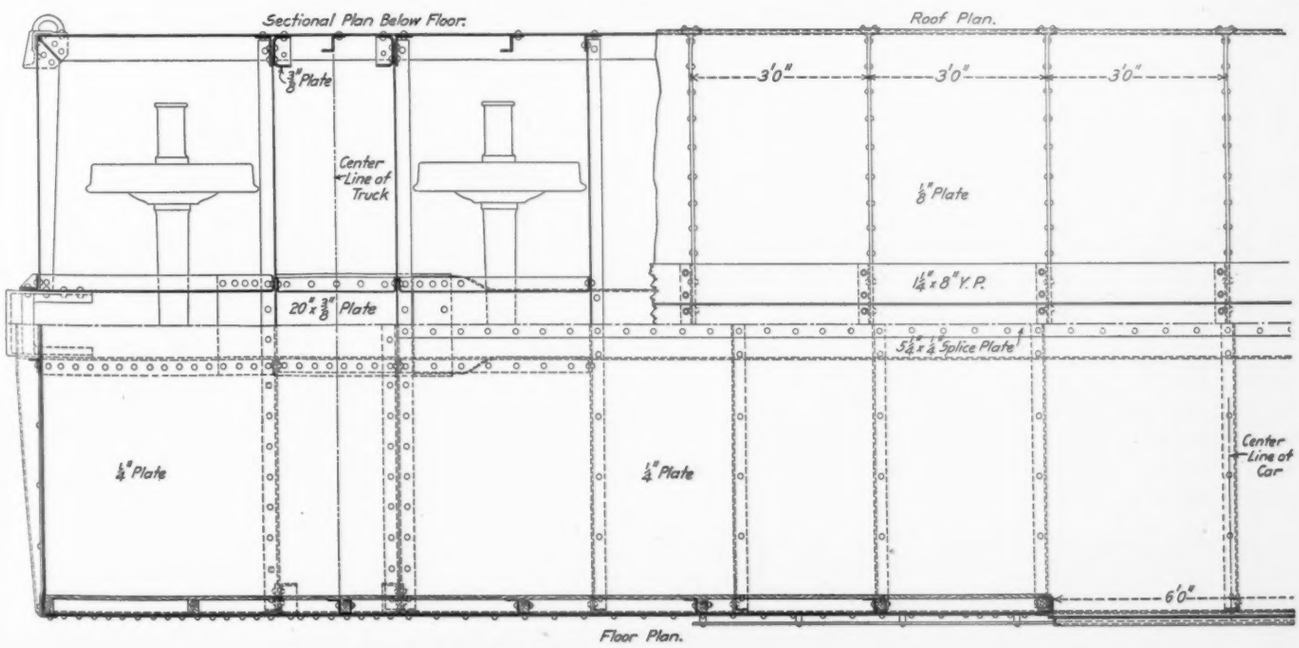
Section Through Side Sill near Center.

body to swing sideways at the bottom but does not allow the sides to sway at the top, with the attendent vertical hammering blows on the side bearings, springs and wheels.

A comparison of this truck and its performance with the standard or center-bearing truck will be interesting and instructive. The center-bearing truck, which at the present time is almost universally used, has one very grave disadvantage. The load supposedly carried on the center plate and evenly distributed to all the wheels, is, by reason of the transverse rocking of the car and the acceleration of this movement by the truck spring reaction and attendant track conditions, at times all carried on the wheels on one rail; not only is it thus all on half the wheels, but by reason of the every increasing load capacity of the cars and the attendant lifting of the center of gravity above the rails, the impact from the side oscilation may double or quadruple the rail reaction. When the impact occurs coincident with the wheel



End View and Sections Through Summers All-Steel Box Car.

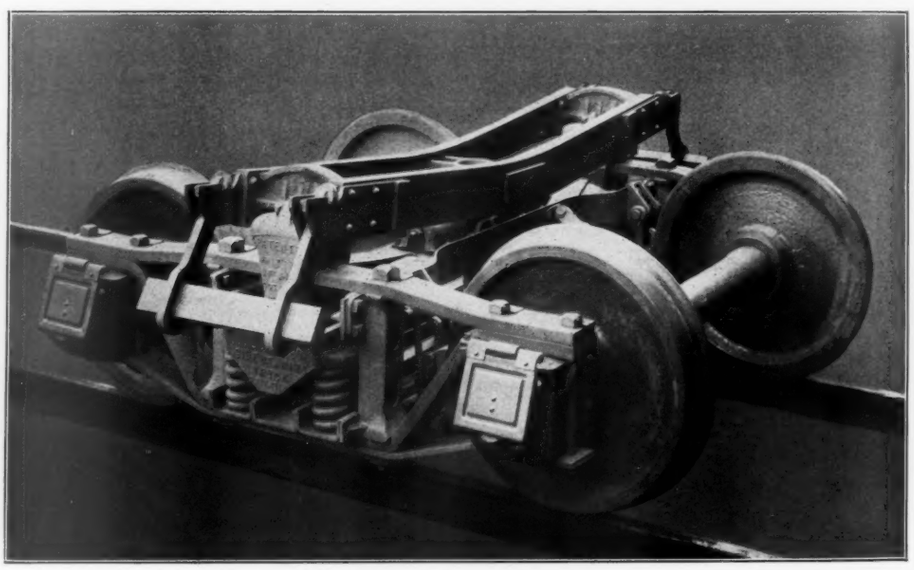


Partial Floor and Roof Plans for All-Steel Box Car; Bessemer & Lake Erie.

traversing a rough piece of track at high speed, a part of the stored energy due to train velocity is converted into vertical impact on the rail.

The new truck illustrated herewith carries the load on the inclined hangers *A*. Cast steel brackets *C* are fixed to the underframe of the car body and cross bars *D* pierce the lower ends of hangers *A* and also fit in a notch in the under side of *C*, the load of the car body being carried through these members to the side bearing or rocker cap *E*, thence into the segmental rocker *F*, which is journaled in oil in the spring cap *G*, transmitting the load through the springs and truck side frame to the wheels. The brackets *C* hold the lower ends of hangers *A* at a fixed distance transversely, while the cradle member *H*, to which *E* is secured, holds their upper ends. When the car is moving slowly along the track, any vertical change in track alinement is taken care of by the rotation of the hangers *A* about their upper ends. With high train velocity the cradle *H* will move instead of the car body, the hangers *A* rotating about their lower ends, thus allowing the car body to move in a straight line, the vertical changes in track alinement being converted into horizontal movement by reason of the difference in inertia of the car body and the cradle. The cradle *H* is held in central position by its center plate *K* and the king pin *L*. The latter has a limited lateral movement at *M* and is returned to the central position by the springs *N*.

The king pin arrangement is clearly shown in the sections through the truck. The construction is of very generous proportions and indicates also that the parts that come into play in moving the truck along are located to advantage. The helical springs between the center pin and truck transom act to check and cushion the transverse swerve of the car body on curves or uneven track; these springs also come into action when the car is traveling at high speed, absorbing the lesser vibrations independently of car, the body and the truck proper. This type of side bearing truck makes it possible to carry the load distributed on all side bearings under any track conditions, and thus distributes the load equally to all the wheels. In a word the truck permits of a rigid car body being carried over the rough track, the wheels moving up and down or transversely without transmitting the motion to the car body.



Summers Balanced Side Bearing Truck.

Steam Wasted at Pops.—Recent tests made by Professor E. F. Miller on Crosby locomotive safety valves, which were described in detail in the September, 1911, issue of the *American Engineer*, showed that with a valve lift of only 0.05 in. the weight of steam discharged per minute, at 200 lbs. pressure, was as follows:

3	in. muffled valve with flat seat having a square edge	96 lbs.
3	in. muffled valve with flat seat having a rounded edge	107 lbs.
3½	in. muffled valve with flat seat having a square edge	114 lbs.
3½	in. muffled valve with flat seat having a rounded edge	127 lbs.

This means that for every pound of steam about 1,200 B. t. u. were wasted, which, when considering that a pound of coal contains 14,000 B. t. u. and that about 60 per cent. of that is used in evaporating steam, and that coal costs about $2.50 a ton, would mean a loss of from $1.00 to $1.35 an hour. Or, looking at it from another point of view, the fireman would be wasting from three to four times the amount of his wages during the time the pops were blowing. If the lift of the valve was 0.10 in. this cost would be just about double.

HINTS TO DRAFTSMEN*

BY WILLIAM FYFE TURNBULL

Many of the draftsman's drawbacks are due to peculiarities of personality. One of the most noticeable of these is the tendency to roam from place to place in search of so-called experience. Real seasoned ripe experience comes from staying in one place long enough to have had personal acquaintance with a great many jobs of different kinds, to have seen what mistakes were made and also what good points were made and how the designs stood up in service.

The draftsman has to contend with office and shop conditions which often require considerable haste in getting the work out. In such cases less time is allowed for thought and study of the design than is really necessary for accurate work, and unless the draftsman has trained himself to work well under high pressure something is almost sure to go wrong.

From one point of view a drawing is a communication with directions for doing work. In other words it is a graphic letter and like a good letter it should be readable, clearly understood and capable of only one interpretation. This may be violated in the first place by not making lines heavy enough and distinguishing lines of different importance. Another mistake is to make an elevation drawing which does not show sufficient detail to insure the clearance of all parts. An illustration of this was a locomotive erecting card on which the position of the reach rod had not been checked at the extreme points, and when erected the line of the rod in one position passed through an air reservoir, which of course had to be moved.

Another drawback is the showing of too few views and sections on a detail drawing. In one case a locomotive crosshead was to be copied and made stronger around the piston rod fit, having the increased dimension carried back to include the wrist pin collar. The original drawing showed a section near the wrist pin, and on this section the draftsman sketched in the increase in size desired. The foundry whose duty it is to follow a drawing and not to assume things, simply made the wrist pin collar higher and left the part around the piston rod as weak as before. There should have been an additional section shown farther up which would have involved considerable more drawing. A drawing cannot be made too plain, even at the cost of additional

*From an address before the American Society of Engineering Draftsmen at New York, February 15, 1912. Mr. Turnbull is with the American Locomotive Company, New York.

time and expense. A dollar in the drawing room has often saved ten in the shop.

From another point of view, a drawing is a description of work which must be made with regard to the strength of materials. This seems obvious, but how often it is forgotten. One cause of this forgetfulness is simple ignorance or the neglect to use the laws of mechanics. As an illustration of this fault a locomotive throttle lever was made in which the relative distances between the fulcrum, throttle rod and handle were such as to necessitate an excessive pull on the handle in order to open the throttle. A little consideration of the mechanical law of the lever would have prevented it. Another case was the attachment of a valve motion combining lever to a crosshead by a pin several inches high. The pin had been figured for shear only, and not for the additional bending due to the eccentric pull; consequently it broke in service. Numerous other such failures may be traced back to the draftsman and designer.

Many calculations must be based on the results of the action of parts in service, for in some instances the stresses are indeterminate mathematically; that is, elements enter in which cannot be measured, and in such cases one must familiarize himself with previous designs, seeking advice from designers familiar with those parts. A further difficulty comes from not considering abuses to which a part may be subjected. Think of the number of handles and lugs located at seemingly inaccessible places on machines, but which are used as steps when not designed for any such purpose. Safety would counsel that this should be considered, and that every structure or machine should be made as nearly fool proof as possible. One instance of this was a grate shaker shaft which was designed to withstand twisting moment due to the pull of one strong man. But at one time the grate became clogged with clinkers and the fireman was unable to shake it so the engineer came to help him out. Their combined pull instead of shaking the grate twisted off the shaft. These situations call for imaginative foresight and an intimate acquaintance with the rough treatment that a machine may receive.

Last of all a drawing is a description of work which must be made subject to the knowledge of shop-men and and the action of machine tools. Draftsmen should have shop experience; they should know what dimensions are necessary to the shop-man and be familiar with the way the work is done. Drawings are frequently seen in which the dimensions given are not those which the mechanic uses in doing the work, and he is consequently compelled to lose time and run the risk of error by calculating the required dimensions for himself. An illustration of this is in giving the distance across the flats of a square shank instead of the diameter of the circumscribed circle, which of course the lathe hand must have in order to turn the piece before it can be shaped square. Again we often find that insufficient clearance is allowed for rivet heads and nuts when these are not shown in detail; bolt holes are also placed so close to a recessed corner that no room is allowed for the wrench. Pipes are often shown bent to impossibly small radii, and insufficient room is allowed in which to put the bend. An offset forging is sometimes seen with dimensions between the centers of the offset parts instead of between the outside flat sides which the smith must measure. Then, too, details are often shown which involve extra labor without any corresponding advantage, such as radii on milled surfaces smaller than the radius of the cutter and necessitating a shaping operation, or in other cases square corners on the outside of bent forgings where no advantage is to be gained. Small points like these involve unnecessary cost.

Following is the advice of a man who has been chief draftsman of a large locomotive works for many years: "Apply the established standards and data of your drawing room. Consult with the foreman of the pattern shop and with the foreman or other experts of construction departments, such as machine shops and boiler shops. Ask advice from more experienced draftsmen, especially from your immediate superior. Investigate the specifications, requirements or restrictions which must govern the production of the part you are to work out. Conserve your time in the interests of those paying for it. Make a few notes that will aid in making you more proficient. Provide proper tools for quick and accurate work. Give your drawings sufficient checking for detection of errors and make corrections before submitting them to the attention of the inspectors. Make an honest endeavor to design so that work may be produced without unnecessary expense. Cease from copying another's design without proper consideration; stop guessing; learn the *what, how* and *why* of your business," and you will be a very successful draftsman and a joy to the engineer who oversees you.

ERECTING SHOP KINKS*

BY E. T. SPIDY,
Former Assistant to General Foreman, Canadian Pacific, West Toronto, Canada

JOURNAL BOX TRUCK.

The handling of journal boxes is a big problem at division points, and especially where they are required to be handled by one man. Fig. 1 shows a truck for conveniently and quickly handling driving boxes. To operate, the truck is run over the box, the handle is raised and the grab hooks are placed in the position shown, one fitting into the oil pocket on top of box while the other

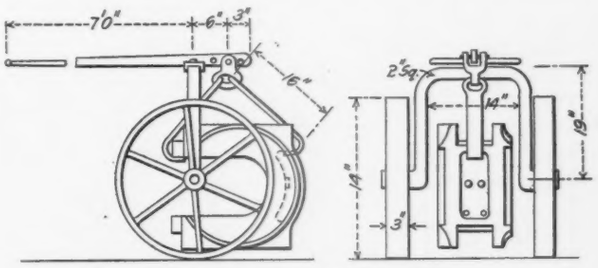


Fig. 1—Truck for Journal Boxes.

rests in the cellar fit at the bottom. When the handle is lowered the box is gripped and lifted from the ground, being held fast by its own weight. The link which carries the grab hook is adjustable on the handle. By placing it in the next hole farther from the support a smaller box may be lifted without excessive motion of the handle, likewise a greater leverage can be obtained for handling larger boxes by using the hole nearest the arch.

PORTABLE OIL BURNER FOR HEATING CYLINDERS.

A convenient arrangement for heating locomotive cylinders when applying bushings is shown in Fig. 2. It is fixed on a truck

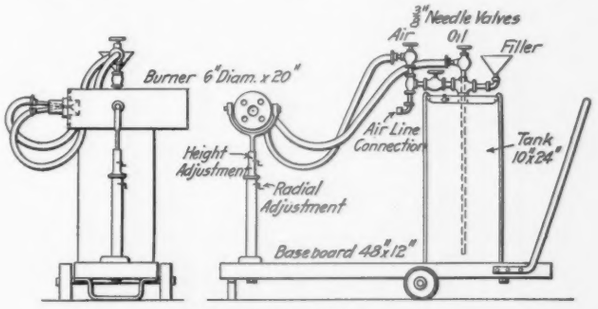


Fig. 2—Portable Oil Burner.

which is placed at the front of the engine between the front end beam and the cylinder, the burner being adjusted to the correct height and angle. It should point to the center of the cylinder about 4 in. from the end. A large sheet iron cone is placed in

*Entered in the *Railway Age Gazette* competition which closed September 15, 1911.

the cylinder, the back of the cone touching the back edge of cylinder while its point reaches near the front end. The flame is directed on the point of the cone which distributes it and heats the inside wall of the cylinder evenly. With the burner shown, a 22-in. cylinder can be heated ready for the bushing in 20 minutes. The details of the piping arrangement are enlarged in the illustration so as to show the construction more clearly. All the air pipe fittings are ¾ in. and the oil pipes are ⅜ in. The idea of trucking the whole outfit was to save the time usually lost in getting and making hose connections. The possibilities of the various uses for a burner of this type are numerous. The same arrangement will fire up boilers for tests, or melt off babbitt from shoes or boxes, etc., thus effecting considerable savings.

TRUCKS FOR RODS OR AXLES.

A hand truck of the construction shown in Fig. 3 is a real time-saver in shops where the handling of driving or truck axles, main or side rods, or similar work, cannot be confined to cranes,

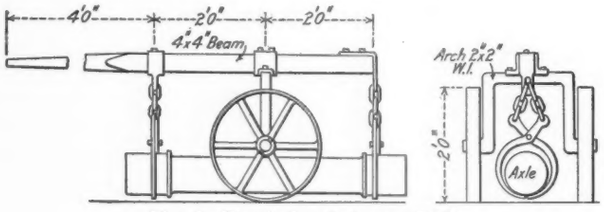


Fig. 3—Truck for Axles or Rods.

and it is much superior to the ordinary hand truck which is commonly used. In operation, it is run directly over the rod or axle, and when the handle is raised the far end is lowered, which allows the jaws of the grab hooks to close over the rod or axle. The handle is then lowered, raising one end of the axle and allowing the nearer pair of grab hooks to be placed over the other end of the axle. On bringing the handle to a horizontal position the axle or rod is lifted clear of the ground and is ready to be transported. The construction of the grab hooks is such that the weight of the carried body tends to tighten them, thus holding the object securely. The truck is of special value where this class of work has to be carried from the store house to the shops or engine house over more or less rough ground; it requires only one man to handle the

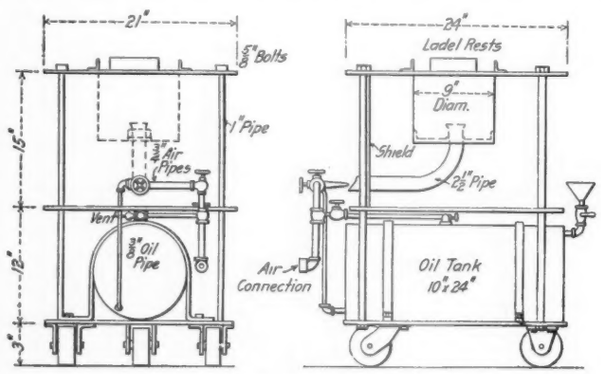


Fig. 4—Portable Oil Babbitt Furnace.

work instead of two or three. The handle is made of wood and the rest of the fittings are wrought iron, with the exception of the wheels, which are cast iron. The chain, the links of which are of 5-16 in. material, should be adjusted so that the bottom of the grab hooks will hang 2½ in. from the ground when the handle is horizontal.

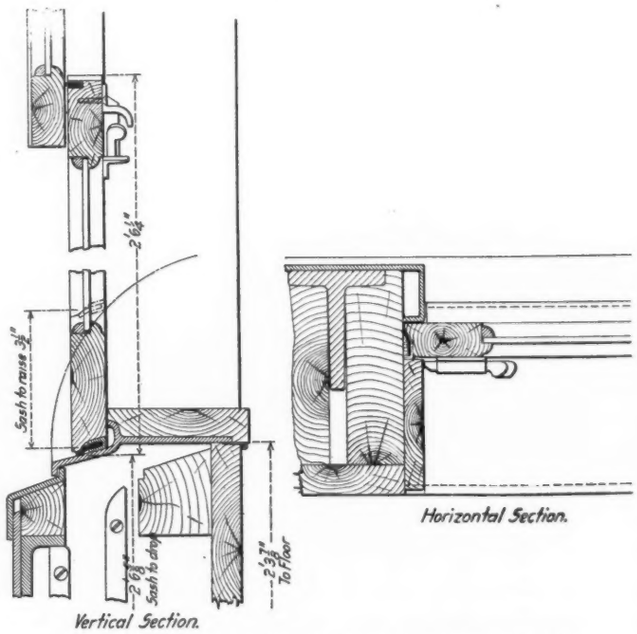
PORTABLE OIL BABBITT FURNACE.

A compact labor-saving device that is adapted to shops that have a variety of babbitting work and where it is inconvenient to take all such work to a stationary fire, is shown in Fig. 4. It is still customary in many shops to melt a ladle of babbitt and to carry it through the shop to where it is to be applied. It is undoubtedly a dangerous practice and unnecessary when such an arrangement as that shown in Fig. 4 can be made from the scrap material found in almost any shop. It consists essentially of three iron plates ¼ in. thick separated by pieces of 1 in. pipe and connected by ⅝ in. bolts passing through the pipes. Pieces of angle iron are riveted to the top plate to serve as rests for the ladle, and both the operating valves are on one side behind the shield plate. The piping arrangement is such that only one connection is necessary to make it ready for use. A babbitt furnace of these dimensions will melt 20 lbs. of babbitt metal in less than 10 minutes.

ENCLOSED OBSERVATION PLATFORM

The observation cars for the Panama Limited of the Illinois Central, running between Chicago and New Orleans have a new feature called a sun parlor. Since these trains operate in daylight at both ends of the route, to make the observation platform available in the north during the winter season it was decided to have it enclosed. The next day, however, the temperature would permit it to be open, and therefore the large windows were arranged to drop out of sight, leaving practically an open observation platform.

The construction of the drop sash is shown in the illustration. A special steel frame capped with wood on the inside is used for the sill, being hinged to the inside finish so that when



Details of Drops in Illinois Central Observation Car.

the sash is raised about 3½ in., it can be swung inward, permitting the sash to fall into the cavity below, and thus be completely covered when the window sill is again in place.

These cars were built by the Pullman Company, and are of composite construction, having a steel underframe and superstructure; the inside finish is of wood. They are 74 ft. in length over the end sills and have a large observation room with a seating capacity of 25 just ahead of the sun parlor; forward of this is a smoking room with a seating capacity for 20, which is enclosed, a side corridor forming a passage to the observation room. A toilet and a small buffet is provided in connection with the smoking room. The cars have total weight of 136,100 lbs. in working order and are equipped with axle light, using a Gould 40-volt, 3 k. w. generator and Edison batteries; also the vapor system of steam heating and Garland type C ventilators.

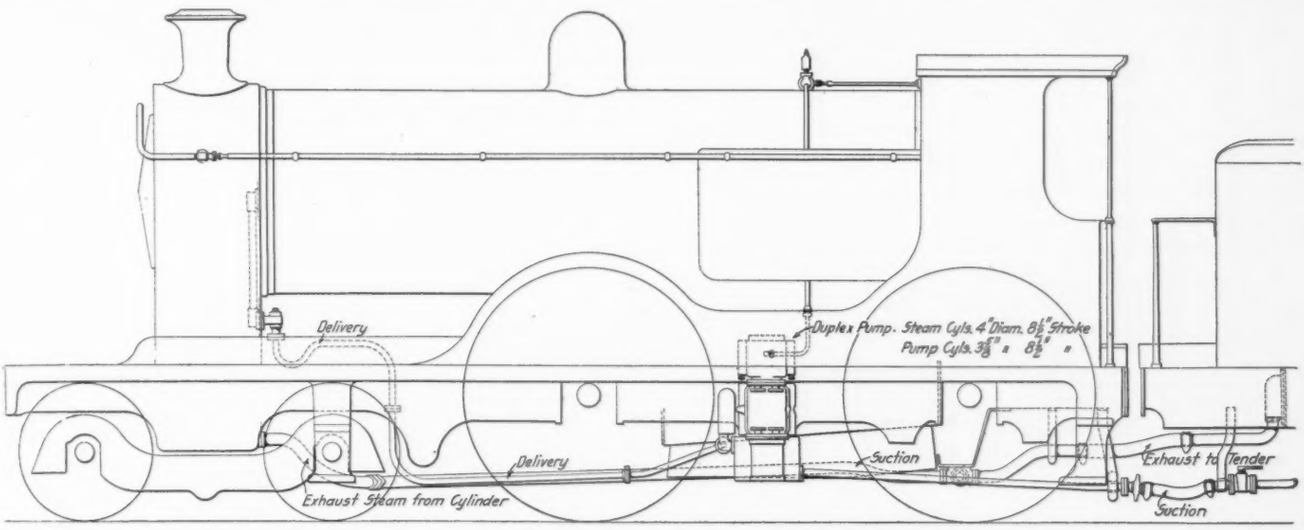
LOCOMOTIVE FEED WATER HEATER

BY GEORGE SHERWOOD HODGINS.

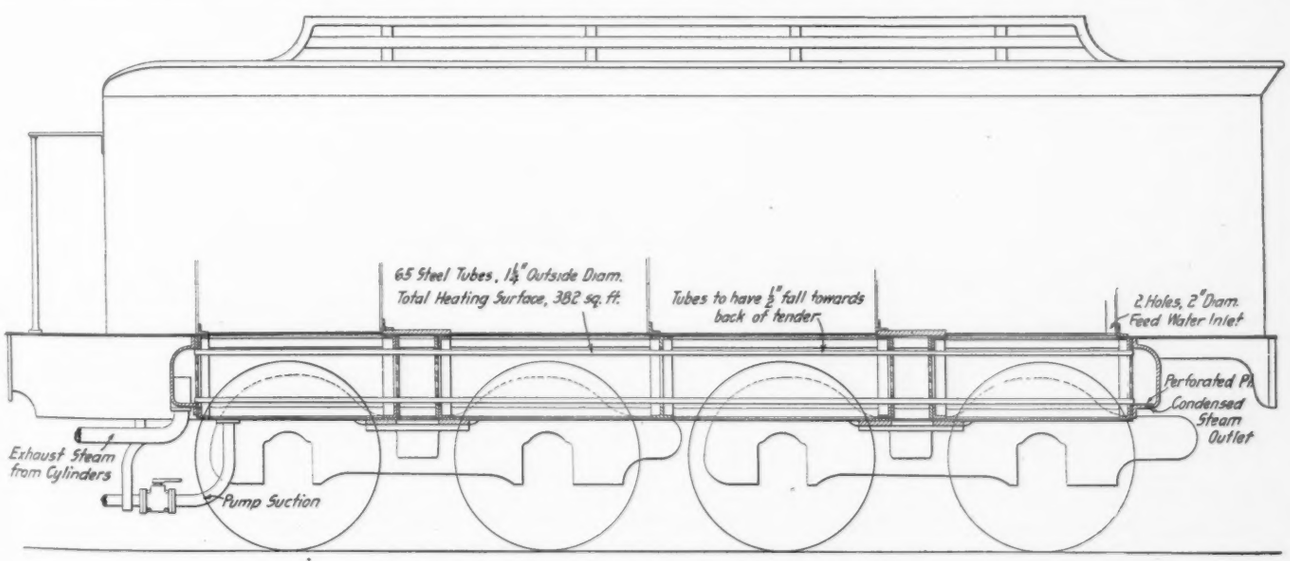
About five years ago D. Drummond, chief mechanical engineer of the London & South Western, devised and applied a method of heating the feed water* on locomotives before it entered the boiler. This arrangement proved so satisfactory and economical that its use has been extended on that road to cover practically all classes of locomotives, and it is stated that an average saving of about 13 per cent. is being obtained when compared with the use of feed water at the ordinary temperatures.

A well, or chamber, 2 ft. 2½ in. in width and about 18 in. deep, and extending the full length of the tender, is provided as a heating chamber, the source of heat being a small proportion of the exhaust steam from the cylinders and the exhaust steam from the duplex pump. In this well are sixty-five 1¼ in. tubes, 18 ft. in length, connecting two cast iron headers. These tubes are given a drop of ½ in. toward the back end and the steam entering the forward header gives up its heat to the feed water surrounding the tubes, is condensed and the condensation is discharged through an opening in the rear header to the ground, falling between the rails.

A duplex pump having steam cylinders 4 in. in diameter by 8½ in. stroke and water cylinders 3⅝ in. in diameter is driven by live steam from the boiler and draws its water supply from the hot well; it discharges through a pipe led forward underneath the boiler to the smokebox and through a check valve on the upper part of the front flue sheet. This pump is generally secured to the frames on the left side of the locomotive, although in some cases it is carried by a casting extending between the frames. On some locomotives two pumps are provided, and on others a regular injector drawing its supply directly from the tank is provided for an emergency. As may be seen in the illustration the hot well on the tender is water tight, being separated entirely from the tank, and obtains its supply through two 2-in. holes at the back end, while the pump suction is located at the front end. In this way there is comparatively little heat transferred to the main body of water in the tank and the water in the hot well is easily maintained at a temperature of about 200 deg., the heating surface in the tubes amounting to about 382 sq. ft.



Arrangement of Feed Water Pump and Piping on the Locomotive.

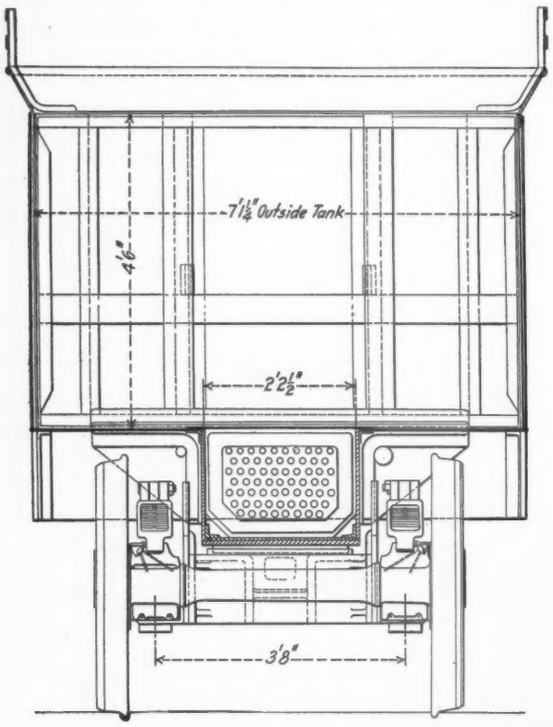

65 Steel Tubes, 1¼" Outside Diam.
Total Heating Surface, 382 sq. ft.
Tubes to have ½" fall towards back of tender
2 Holes, 2" Diam.
Feed Water Inlet
Perforated Pl
Condensed Steam Outlet
Exhaust Steam from Cylinders
Pump Suction

Longitudinal Section of Tender Showing the Hot Well.

It is a practice on the London & South Western to start the

*American Engineer & Railway Journal, May, 1907, page 184.

pump as soon as the locomotive is started, and to maintain the water level by governing the speed at which the pump is oper-



Section of Tender Fitted with Feed Water Heater.

ated, so that it works continuously and the supply of water to the boiler can be made to exactly equal the demand.

Cash Value of Employees.—In a statement issued to the employees of the road, President H. U. Mudge of the Chicago, Rock Island & Pacific, capitalizes each man earning $83.33 a month, or $1,000 a year, at $25,000, because the man's wages or salary is the interest of 4 per cent. on $25,000. He says a man earning that much is worth as much as a locomotive costs, but he adds: "You can make yourself worth more, while a locomotive cannot. You can direct your own energies, while a locomotive must be directed by a driver. It rests with you to raise your own capitalization to $50,000, to $100,000, or even to $500,000. Therefore be careful about your food, treat your body decently, and, above all, feed your mind. You are working for a large corporation. In the nature of things it cannot know you very well personally, but it knows you by the work you turn out. It sets a real value on your work, higher than you think. Your value is measured by the quality and quantity of results you produce. Somebody knows your actual worth, appreciates your honest endeavors and has you in mind for better things. It is a business proposition. Each of us is capitalized."

Train Resistance.—A formula for train resistance is given by the Baldwin Locomotive Works as follows:

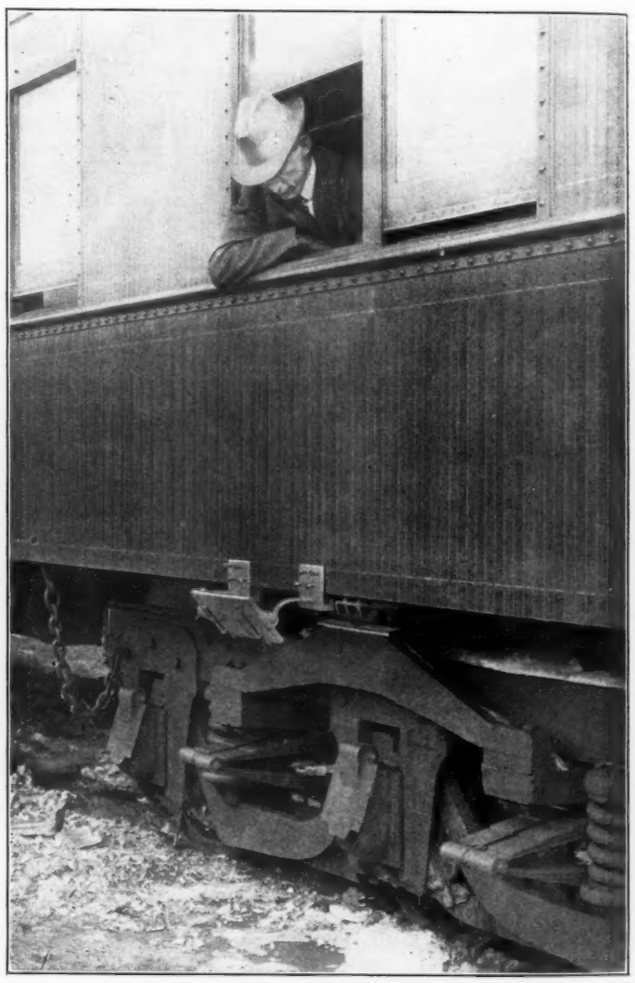
$$R = 1.8T + 100N.$$

Where R equals total resistance of train in pounds, T equals the weight of train in tons (both of these being exclusive of engine and tender) and N equals the number of cars in the train. This formula applies for a speed of 5 m. p. h. and for speeds greater than that, 2 per cent. of the result should be added for every mile per hour greater than 5 up to 30 m. p. h., beyond which speed the formula does not apply.

German Vacations.—It is proposed in Germany to change the end of the school year in different districts or states so that the vacation may begin at different seasons, and the summer travel on the railways be more evenly distributed.

INSPECTING SIDE BEARING MOTION

There is considerable uncertainty in regard to the action of several important details when a car truck is in motion, and careful observations of this action would be of material assistance to those who are endeavoring to improve these details. The movement of side bearings is a subject which is constantly under discussion, but on account of the difficulty of inspecting them when the car is traveling in regular service, very little is known as to their actual performance. The illustration shows a mirror arrangement which was devised by Edwin S. Wood & Co., Chicago, for observing the action of side bearings from the car window. The mirror is secured to the lower edge of the car side opposite the side bearing, and the angle is such that the image is reflected vertically and the motion of the truck with respect to the car body can be clearly seen. Various modifications of the



Mirror for Inspecting Side Bearing Motion.

same principle can be used for the purpose of observing the motion of the journal boxes, springs and equalizers, etc.

It is claimed by many that the friction of the center plate and side bearing is sufficient to hold the truck out of square after it has left a curve and entered a tangent. By a simple arrangement of the mirror this action could be readily inspected and some useful information could be derived from such a study. Here is a field for investigation which has not been properly cultivated, and with the assistance of the mirror it ought to be possible to obtain a number of valuable facts relating to truck motion and the action of truck details when moving rapidly, which should lead to important improvements.

FLANGE PRESS WORK IN RAILWAY SHOPS

An Analysis of the Economies Possible from the Efficient Operation of a Modern Flange Press in a Railway Shop for Both Locomotive and Steel Freight Car Work.

BY LEWIS D. FREEMAN.

Comparatively few roads appreciate the value of the hydraulic flange press as a cost reducing proposition and the object of this article is to point out the advantages of a properly equipped flange shop, such as would be suitable for the maintenance of upward of 500 locomotives and 15,000 steel cars. The flange shop herein decribed is supplying parts for 2,000 locomotives and approximately 90,000 cars, about one-third of which are of all-steel construction. Take a railway that buys 50 new locomotives that all go into service about the same time; after about five years of service, which is a fair average, the fireboxes will require renewal. This work will have to be done quickly to reduce the time that the locomotives are held out of service to a minimum.

Labor in making the repairs is the next most important factor. Hand flanging on the open fire is to be avoided as much as possible as it is expensive and unsatisfactory since the sheets cannot be kept hot long enough to flange but a small portion at a time, and the frequent heatings set up internal stresses in the sheets which cause cracks and other troubles; also it is practically impossible to flange a sheet by hand that will conform to the exact dimensions required. The cost of hand flanging is

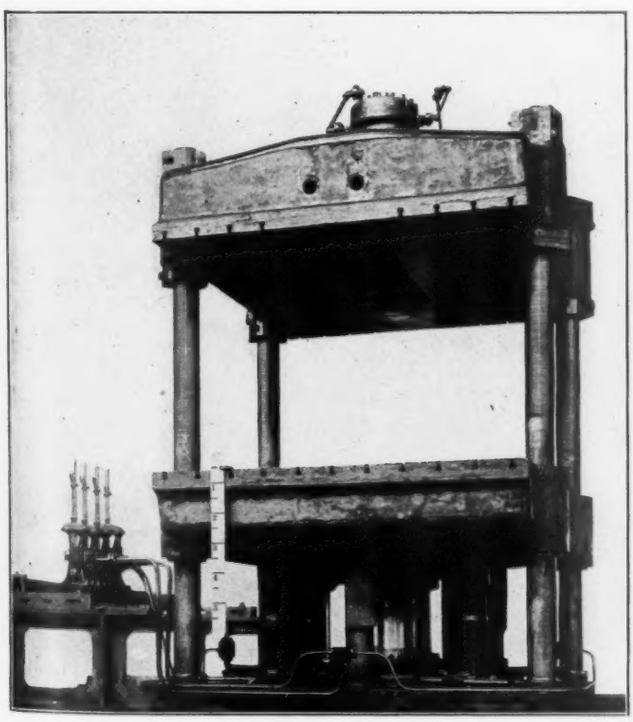


Fig. 1—Hydraulic Flange Press of 800 Tons Capacity.

almost prohibitive, it being, roughly, about nine times the cost of flanging on a modern hydraulic press. For example the cost of the renewal of 50 fireboxes and front flue sheets when done by hand and by the flanging press is as follows:

	Hand.	Flange Press.
50 Front flue sheets	$400.00	$45.00
50 Back flue sheets	675.00	75.00
50 Furnace door sheets	675.00	75.00
Total	$1,750.00	$195.00

The net saving on this one job would be $1,555, without taking into account the difference in time to perform the work by the two methods. One gang of five men can probably flange two front flue sheets per day while the same gang can flange but one back flue sheet or furnace door sheet. This does not compare very favorably with the hydraulic press where 30 back or front flue sheets is only a fair day's output after the formers have been set, with a crew of five men consisting of one press operator and

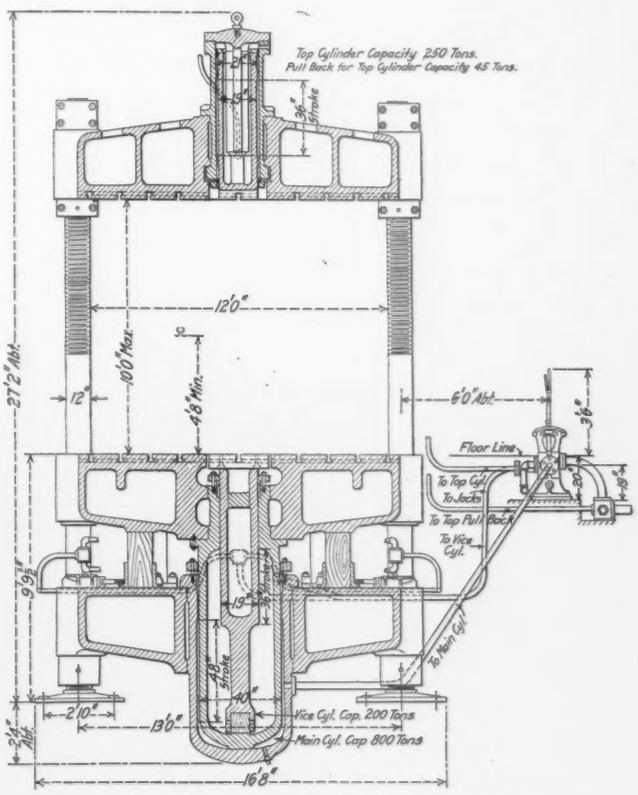


Fig. 2—Vertical Section Through Hydraulic Flange Press.

four laborers. It would not be a wise plan to flange more than 30 of any one kind of plates for stock, as too much money would be tied up in stock material and it would pay better to set up the formers oftener.

Assume that the road operates 1,500 locomotives with an average life of fireboxes of five years; this would mean the renewal of 300 fireboxes annually with a saving of $9,330 per year over the hand method of flanging, as well as having the sheets exact duplicates of each other. By properly designed formers the sheets will fit the boilers more accurately, thus saving time in the fitting up process. In addition to the firebox work there are ash pan pockets over the wheels, sand box casings and smokebox fronts, which are a decided saving over the cast iron fronts, as the latter give trouble by cracking, especially during the winter months. The locomotive work just described will occupy about four working months' time, leaving the remaining eight working months for the manufacture of pressed steel car parts. Suppose 15,000 all-steel cars have been in service for a sufficient time to require frequent renewals of the more important parts to the

extent of $10.80 per car per year which is only 10 per cent. of the $108 which has been published as the average repair cost of all the freight cars in the United States. This would require the annual expenditure of $162,000 for pressed steel repair parts if they were purchased from the various car manufacturers. This

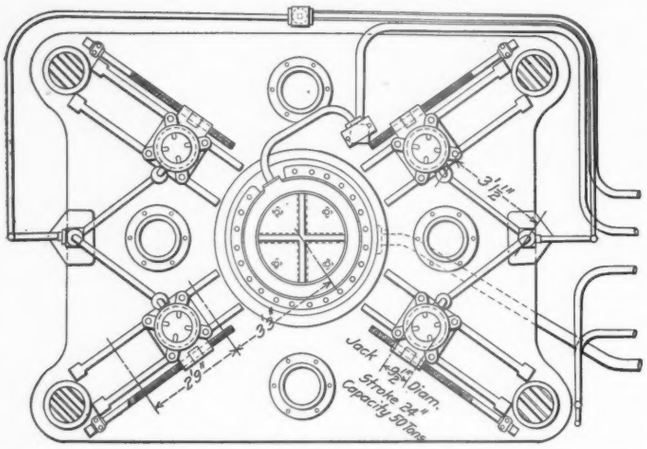


Fig. 3—Plan of Flange Press Showing the Four Auxiliary Plungers.

cost is at the rate of about 5 cents per pound for the parts ready for application to the cars. This same amount of material can be produced in the railway company's shop for about 2.5 cents per pound or at a saving of 50 per cent. or $81,000 per year. However, as the cars grow older this repair cost will undoubtedly increase until the cost of maintenance becomes too great for economical operation. The investment necessary for a flange shop, as herein described, will be in the neighborhood of $50,000 and the operating expenses covering the interest on the investment, engineering expenses, labor and power for a ten hour day operating basis will be about $24,000, which deducted from the gross saving on both car and locomotive work of $89,330 will leave a net annual saving of $65,330, which is well worth consideration.

DESCRIPTION OF THE PRESS.

A photograph of a 12 ft. x 15 ft. hydraulic flange press, designed and built by the Bethlehem Steel Company, is shown in Fig. 1. By referring to Fig. 2 which is a cross section through the vertical center of the press, it will be seen that there is a top plunger 19 in. in diameter which works downward with a stroke of 36 in. and exerts a pressure of 250 tons; also a "pull back" which returns the plunger to its normal position. In the center of the lower platen is the 19 in. vise plunger which has a 36 in. stroke. No provision need be made for returning this plunger as it will fall of its own weight as soon as the pressure is released. The cylinder of this vise plunger, which is bolted to the lower or moving platen and serves as the plunger for the main platen, is 40 in. in diameter and has a stroke of 48 in. upward and exerts a pressure of 800 tons. In addition to these plungers there are four slots cut in the lower platen, as shown in Fig. 3, through which project four auxiliary plungers called jacks which operate independently of the other plungers. These jacks are 9½ in. in diameter and have a 24 in. stroke, with a capacity of 50 tons each. They are adjustable in a horizontal plane to the extent of 2 ft. 9 in., the closest distance to the center plunger being 3 ft. 3 in. All of the cylinders are outside packed having bronze flanges and bronze guide bushings, hemp packing being used. With this arrangement it is easy to repack the cylinders.

The top platen is adjustable to any height between 4 ft. 8 in. as a minimum and 10 ft. as a maximum above the moving platen; the most convenient setting has been found to be about 7 ft. 6 in. for most classes of work.

WATER SUPPLY.

The transmission of power by water is about the most economical method, having an efficiency of about 94 per cent. The water for operating this press is obtained from a large tank of clean water which is returned from the press cylinders after passing through them. The pump is shown in Fig. 4. It has three double acting 3¼ in. x 12 in. cylinders, and was made by the Chambersburg Engineering Company. This pump delivers 100 gals. per minute when running at 40 r. p. m. and is geared

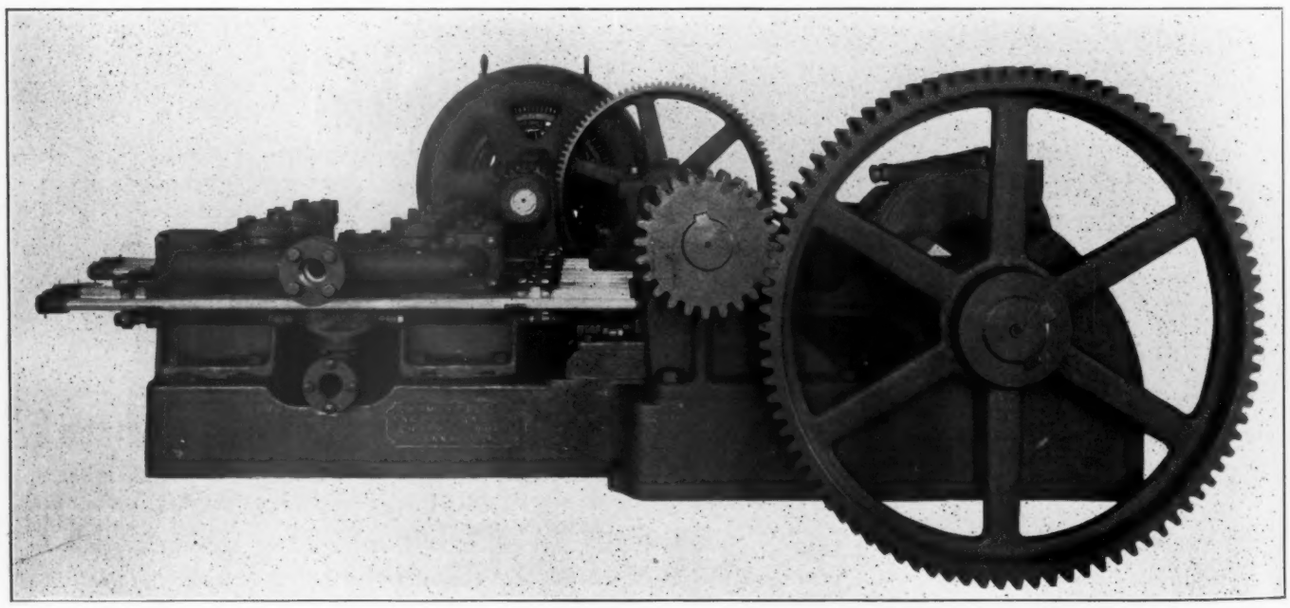


Fig. 4—Heavy Duty Pump for Hydraulic Flange Press.

direct to a 125 h. p. 500 volt d. c. motor running at 500 r. p. m. The water pressure is 1,500 lbs. per sq. in.

ACCUMULATOR.

In order to have a sufficient supply of water at the pressure of 1,500 lbs. per sq. in. two accumulators are connected in series by a 3 in. double extra strong pipe between the pumps and the press valves. Fig. 5 represents a cross section through one of the accumulators, which is a large vertical cylinder having a 12 in. plunger, which has outside packing flanges at the top. A large steel tank filled with sufficient scrap punchings to produce a pressure of 1,500 lbs. per sq. in. is supported on the plunger. A

by-pass valve is so arranged that when the accumulators reach their upward limit, which is 12 ft., the discharge from the pumps is turned from the accumulators into the supply well so as to save the water and to keep the pumps operating constantly.

HEATING FURNACE.

The output of such a hydraulic press outfit is limited to a certain extent by the capacity of the heating furnace used in connection with it. The coke furnaces have been replaced by

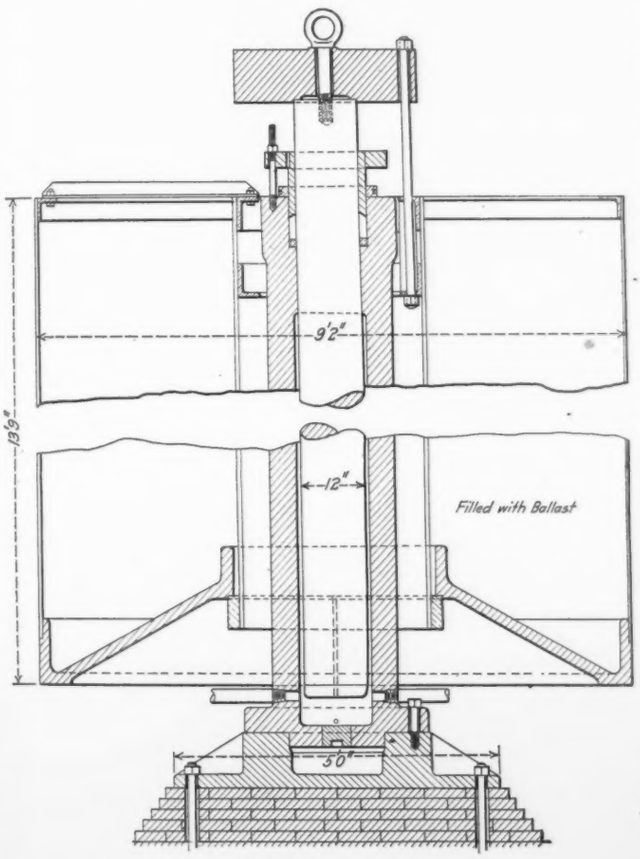


Fig. 5—Accumulator for Hydraulic Press.

the oil furnaces which give quicker heats and are less troublesome. There are no ashes and the oil takes up less room, as one gallon will produce 144,000 B. t. u. which is equivalent to 12 lbs. of coal.

Fig. 6 shows a Ferguson oil furnace made by the Railway Materials Company that is used in connection with the hydraulic press just described. This furnace has four burners with combustion chambers self contained so that the oil and air are vaporized in the burner and by an auxiliary air passage, sufficient air is admitted in this combustion chamber to provide for perfect combustion. The air is supplied by a belt-driven fan, the pressure being about 8 ozs. The oil is supplied from an underground tank at a pressure of about 8 lbs. per sq. in., these tanks being located in an oil house outside of the building and convenient to the tracks on which the oil car is brought in. Old car axles are placed in the furnace and act as rollers on which the material to be heated can be easily and quickly handled in and out.

OPERATION.

Following is an analysis of the most economical plan of operation in which the maximum output can be obtained for the money invested. Too many master mechanics either through ignorance or negligence do not realize the importance of the flange shop and do not give it the attention necessary for the most economical operation; it should be placed in the hands of an expert capable of producing the best possible results.

Two plans of operation will be considered—the 10-hour day and the 23-hour day plans. The degree of efficiency in either case will depend on the ability of the operating officer. The 10-hour day plan produces less work per hour than the 23-hour day plan for the following reasons. The usual method is to pay the men on a day work basis for setting formers and taking care of the furnace and on a piece work for the actual flanging operations, which is satisfactory to both employer and men. When the shop is operated only ten hours per day the furnace is cold when the men report and has to be first filled with the material to be heated; three hours will be required to bring this material up to the proper flanging heat. If the furnace is filled with a large number of small or medium sized plates this material cannot be pressed before noon and the fire will have to be turned out until after 1 p. m. to prevent overheating; it will be about the middle of the afternoon before the furnace is free to be filled again with fresh material. This time it will only require about one hour for heating, as the furnace is already hot. This second furnace full will probably not be all flanged before 6 p. m. and the remainder of the material will have to be left in the furnace until the following day.

From the above statement it may be seen that three hours each day are lost in getting the furnace hot, thus reducing the efficiency of the whole hydraulic flange shop by 30 per cent., in addition to the time and oil necessary to reheat any material left in the furnace from the previous day. The second plan of operation is to run the press 23 hours per day, having two shifts of men, one shift working six days of ten hours and the other shift working five nights of 13 hours each. In this way the work can be so arranged that the day shift will come in at 7 a. m. and

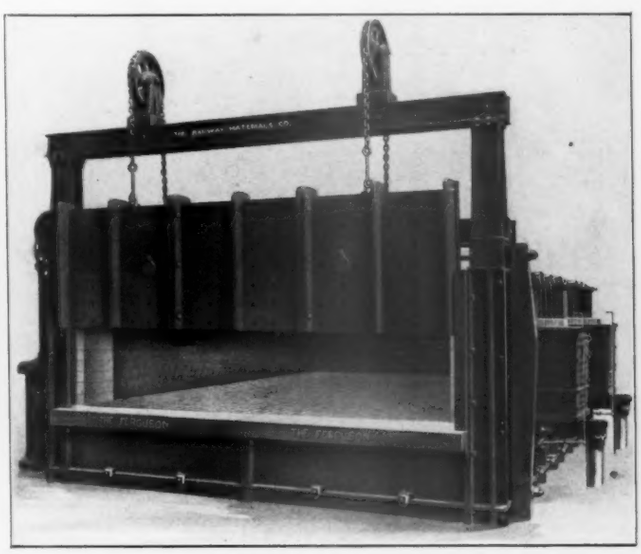


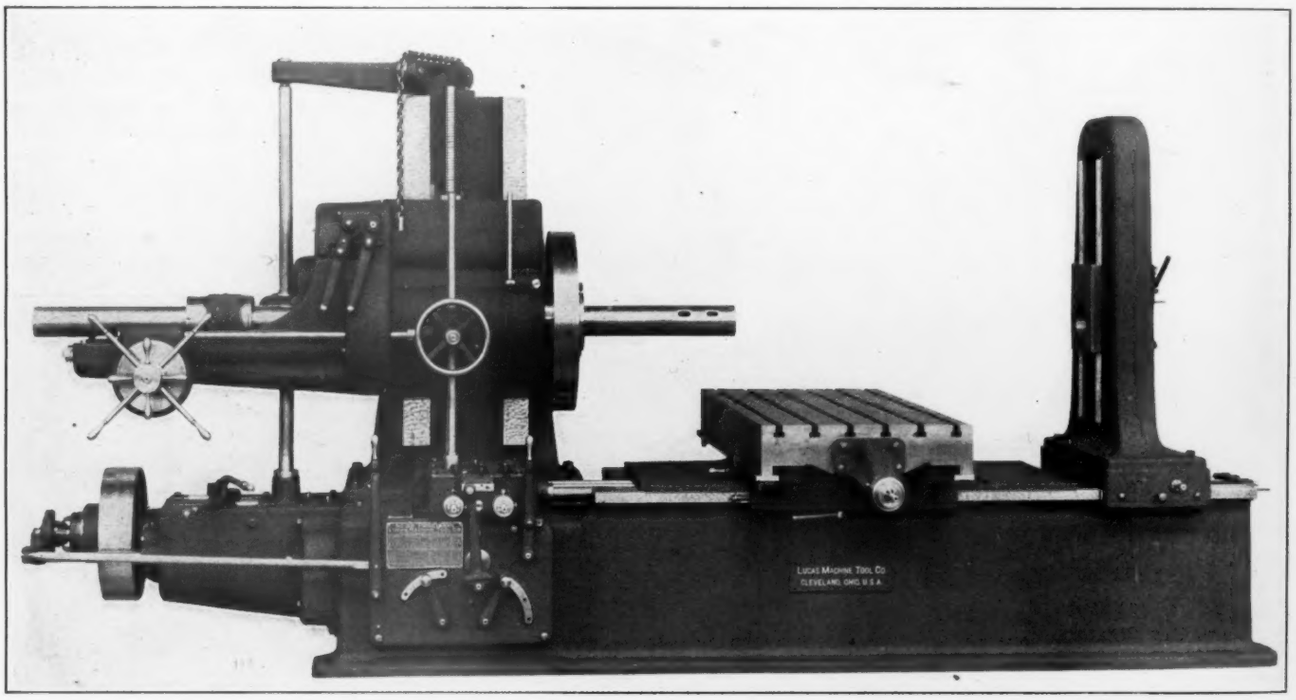
Fig. 6—Oil Furnace Used In Connection with Flange Press.

always have a furnace of hot material to begin the day's work, thus having time to empty the furnace before noon. It may now be filled up again with fresh material allowing the furnace to run during the noon hour and after 1 p. m. the second furnace charge will be ready for flanging and before 6 p. m. the second furnace full will have been worked up and the furnace will again be filled up for the night shift, which reports at 6 p. m. They can finish two full heats and have the furnace hot and filled with hot material for the day shift on the following day. From this it will be seen that the loss of three hours per day in getting the furnace hot is entirely eliminated and two shifts of men can produce four full heats in 23 hours, while one shift can only produce one and one half full heats per day of ten hours, the advantage being in keeping the furnace hot all the time.

POWERFUL HORIZONTAL BORING, DRILLING AND MILLING MACHINE

About a year ago the Lucas Machine Tool Company, Cleveland, Ohio, brought out a new design of horizontal boring, drilling and milling machine* which, by virtue of its range of operations, convenience of control, power and accuracy attracted much attention. The advantages of this tool appealed strongly to many railway shop superintendents, and largely on the basis of their suggestions, a larger, more powerful, and more rigid machine of the same general type has been designed, which it is believed will fulfill the requirements of the heavy, rapid work demanded by railway shops. The new machine has been designated as No. 33, while the former one is generally known throughout the trade as the No. 32.

Like the former design it may be fitted for use as a vertical milling machine, if required, and with this attachment it becomes very nearly a universal drilling, milling and boring machine.



Horizontal Boring, Drilling and Milling Machine, Designed for Railway Shop Use.

It is especially suited for such work as boring, facing and drilling air pump cylinders, boring and facing driving boxes; boring cylinder bushings, drilling mud rings; machining steam pipes and exhaust nozzles; boring crossheads; boring rocker arms and link saddles; boring and milling (with gang cutters) cylinder castings; milling key seats, and facing packing glands and seats.

The principal feature in the arrangement of this machine is probably found in the quick return power movement to all parts having feeds. This is so arranged that no matter what feed is used a constant speed quick return can be obtained by simply moving the quick return lever to the reverse position. This is true no matter in which direction the feed is being given, and will give a rapid vertical movement to the head in either direction, or a cross movement to the platen, or longitudinal movement to the saddle, or longitudinal movement to the spindle, all by the use of the same lever, the part effected depending on the position of the interlocking feed selecting levers on the cover of the gear box. The arrangement is such that it is impossible to use the power movement when any feed is engaged or to engage any feed when the power movement is in use. The feed selecting levers are also interlocked and they are so arranged that one can be used at a time.

The spindle drive is of the internal gear face plate type for the slower speeds but for the faster ones the pinion is withdrawn from the internal gear and other gearing is engaged at the opposite end of the spindle sleeve, thus eliminating the necessity of running the pinion shaft at very high speeds. This change is made by the levers shown on the front of the spindle head near the top. These are interlocked and but one set of gears can be engaged at a time. The face plate may be removed to make place for lighter work when face milling cutters of small diameter are used.

The illustration shows that the matter of centralized control has been fully carried out and that it is possible for the workmen to reach any of the controlling levers from one position. The two small levers shown near the bottom of the feed box control sliding gears give 9 changes of speed, the back gears providing a total of 18 changes, ranging from .004 in. to .735 in. per revolution of the spindle. These speeds are applicable to the spindle, the spindle head and tail block, the saddle, and the platen and are at the same rate wherever applied. The selection of the part to be effected by the feed is obtained by means of the three small levers, the ends of which may be seen at the top of the feed box. The longer lever in front of the feed box is for reversing the feed and on either side of this are the hand adjustments for the saddle and the spindle head respectively, each having a micrometer dial which in the illustration makes them appear like small wheels. To the right of and projecting above the box is the feed and quick return lever which operates on any feed that may be in use and gives the quick return in either direction.

The longer lever located at the left of the feed box is the starting and stopping lever which controls a friction clutch at the end of the driving shaft. The primary drive, whether by belt or motor, is constant speed and the variations of spindle speed are given by a gear box with a range of from 5 to 150

*See *American Engineer & Railroad Journal*, April, 1911.

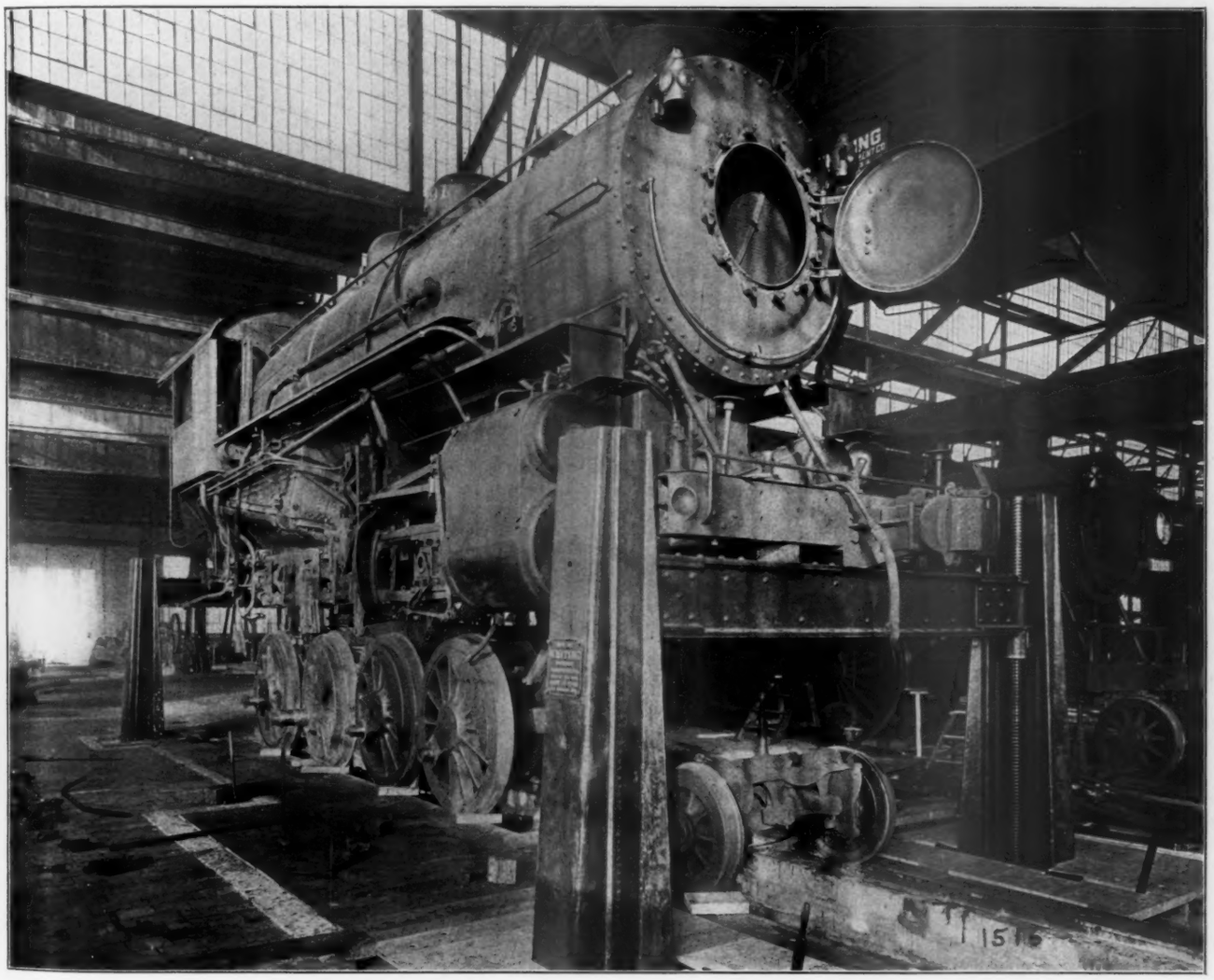
r. p. m., this being controlled by two levers setting in a horizontal plane shown near the driving pulley in the illustration. The round hand wheel on the head at the front is for slow spindle movement while the one with four long handles at the extreme left is for quick spindle hand movement. The two levers extending downward on the head control the interlocking back gears. On the platen is a hand adjustment with a micrometer dial and also an adjustable feed trip.

When the vertical milling attachment is applied, its spindle head is capable of being fed along the rail by power which, in combination with the other power feeds for the saddle and platen, gives the machine a wide range of usefulness for face milling. The crossrail required for this purpose is easily removed or applied, the same also holding true for the back rest.

near the center and drives through the shaft extending to the chain of gears which take the place of the driving pulley. One of these tools will be exhibited at Atlantic City during the convention next June.

ELECTRIC LOCOMOTIVE HOIST

An electric screw jack locomotive hoist for use in shops not provided with overhead cranes of sufficient size to lift locomotives, is being made by the Whiting Foundry Equipment Company, Harvey, Ill. These hoists are made in capacities from 100 to 200 tons, and will unwheel a locomotive complete in one-half hour from the time it is brought into the shop to the time



Electric Locomotive Hoist Wheeling a Large Consolidation Locomotive.

The power and rigidity of the machine are well indicated by its appearance and from the fact that it weighs about 18,000 lbs. without extra attachments. The spindle has a diameter of 4½ in. and a total traverse of 60 in. The maximum distance from the face-plate to the outer support for the boring bar is 7 ft. and from the top of the platen to the center of the spindle it is 28½ in. The platen measures 30 in. x 56 in. and has a 44 in. cross feed. The driving pulley on the belt driven machine is 20 in. in diameter and its face is suited for a 4½ in. belt. It runs at 300 r. p. m. When the mill is motor driven, a 10 h. p. constant speed motor, running at about 1,000 to 1,200 r. p. m. is recommended. The motor is mounted on the rear of the bed

everything is cleared away and it is drawn out on shop trucks. The installation shown in the illustrations is in the shops of the Chicago & North Western at Boone, Ia.

The mechanism consists of two stationary screw jacks located on concrete foundations on either side of the stripping pit. At the opposite end of the pit are two similar jacks mounted on trucks operating on independent tracks parallel with the pit track, and providing sufficient travel to accommodate the different lengths of locomotives to be handled. A removable structural steel girder extends across the track, between each pair of jacks, one being located under the tail-bar and the other under the bumper beam of the locomotive. A motor which may be from 25 to 40 h. p.,

depending on the capacity and speed desired, is so connected to the jacks as to drive both simultaneously or each independently, as desired. The travel of the movable jacks is accomplished by a hand-operation device.

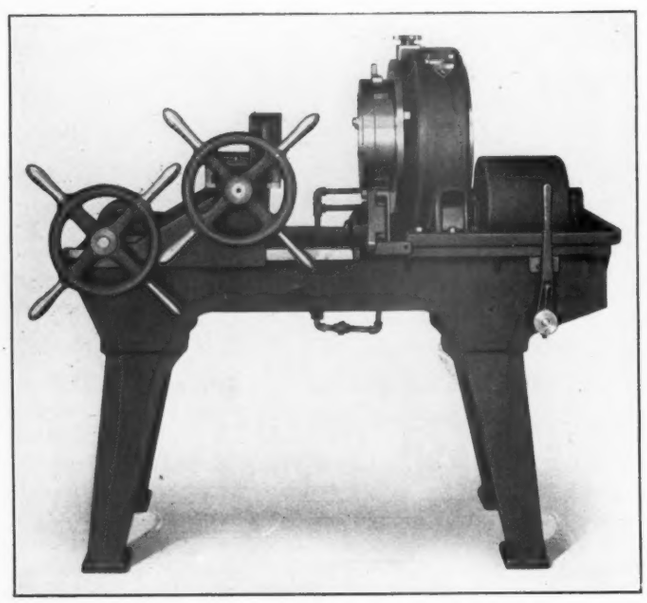
While a five-ton electric crane is shown handling the cross

Electric Locomotive Hoist When Not In Use.

bar in the illustration, this is not a necessary adjunct to the hoist and a trolley or jib crane could be used as well. In new shops, however, such a crane would no doubt be available.

PIPE THREADING AND NIPPLE MACHINE

A substantial, rigid machine, which will not only cut off and thread pipe, but will also without the use of a nipple chuck do the same with nipples, has been designed by the Loew Manufacturing Company, Cleveland, Ohio. This machine is of the pedestal type, and while having a revolving die head is claimed to possess all of the advantages of the barrel type machine. The revolving head has a self-locking and self-releasing feature which



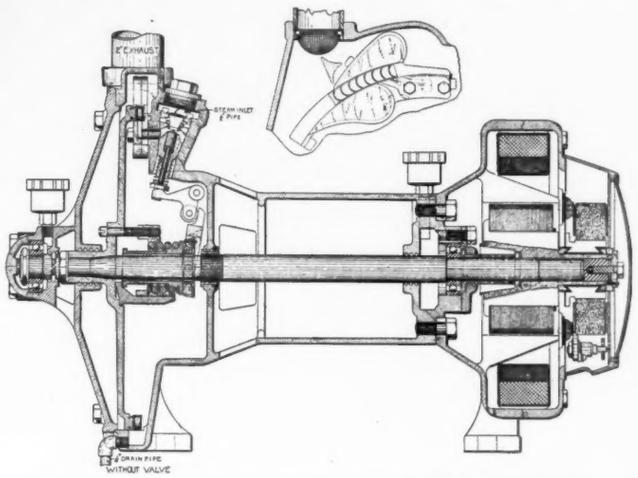
Loew Pipe Threading and Nipple Machine.

can be thrown into action easily. The cutting off tool is on the head and is fitted with a star wheel feed arrangement. It is so located as to be easily set to cut off the proper length, even when the largest size pipe within the capacity of the machine is being handled. Two changes of speed, obtained by shifting gears, are provided, and no counter shaft is used. Tight and loose pulleys are provided on the belt-driven type.

HEADLIGHT WITH IMPROVED TURBINE.

The steam consumption of turbo-generators has been considerably reduced in Equipment E of the Pyle National Electric Headlight Company, Chicago, and the new generator here illustrated requires only about one-third as much steam for a given candle power hour as used in the older equipment. The turbo-generator operates on steam pressures ranging from 100 lbs. to the highest used in locomotive practice, and on superheated steam as well as saturated steam without any adjustment. The speed of the type E generator is only 2,400 revolutions per minute, and at that speed the efficiency is equal to that of turbines running at 4,000 to 5,000 revolutions.

The dynamo construction is based on the most recent im-



Improved Turbine for Pyle-National Electric Headlight.

provements, and the electrical balance is so perfect that no sparks should be seen at the brushes. The brush holders are fixed and the brushes may be taken out and replaced without changing the tension of the springs. The fields are compound wound to allow the burning of either the arc lamp or the cab lights independently. The armature on the new E equipment is interchangeable with all others made by the company. The bucket wheel of the turbine is made of steel and has only one row of buckets, but the steam passages outside the nozzles are arranged so that three impulses are delivered by the steam before it escapes. The governor is of the tension spring type, surrounding the main shaft and operating a balanced valve by means of levers. The tension of the spring is set for the desired speed of 2,400 revolutions before leaving the works.

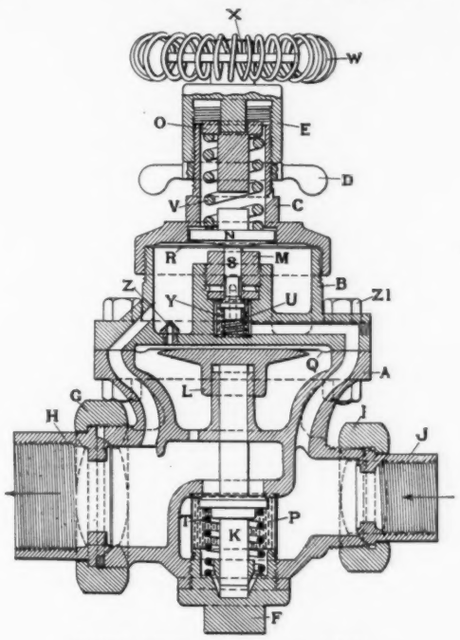
German Church Passes.—The employees of the Baden State Railways, Germany, who are stationed at places where there is no church of their confession, are granted free passage on trains to the nearest station where there is such a church on Sundays and church holidays. Their wives and their children under 18 are to have the same privilege. Heretofore they were limited to twelve such journeys a year.

Coal Shipments.—The shipments of anthracite coal by the Philadelphia & Reading during the month of February were the heaviest in the history of the company, aggregating 784,000 tons. It is said that coal trains were despatched from the yard at Pottsville every half hour during the month.

GOLD'S IDEAL PRESSURE REGULATOR

Pressure regulators for car heating have in the past given considerable trouble, because of the sticking of the sliding valves and the unequal expansion of the double seated valves and their seat supports, making them unreliable and subject to frequent repairs, cleaning and adjusting. Moreover, they required regulating when there was a material drop in the boiler pressure, or an added demand on the steam supply. The Gold Car Heating & Lighting Company, New York, has developed a new regulator, known as Gold's Ideal pressure regulator, which does not possess these defects and regulates uniformly and practically automatically.

The following severe test of one of these regulators was recently made by Arthur M. Waitt, the following being an extract from his report: "The Gold Ideal regulator was applied to a standard passenger locomotive, which was then coupled to a train of five average sized modern passenger coaches. A steam gage was connected with the train supply pipe, from where it



Gold's Ideal Pressure Regulator.

was attached to the regulator, and it constantly indicated the exact pressure maintained at that point. After coupling the steam hose between all the coaches steam was furnished to the train pipe, as far back as the rear of tender, by opening the regulator sufficiently to furnish a pressure of 30 lbs. on the train supply or outlet side of the regulator. With this setting steam was admitted first to the train pipe and radiating pipes of the coach next to the locomotive. After waiting several minutes until steam showed at the drip on this coach the steam was admitted to the train and radiating pipes of a second car, and it in turn was heated until steam showed at the drip. Next three more coaches were at once added to the train being heated. After allowing steam to be on the entire five cars for over five minutes the hose on the rear end of the rear coach was fully opened, allowing steam to blow freely from the train pipe. After allowing the rear hose to be open full for two minutes, the cars were all cut off at once by closing the cock on the front end of the first car. The next test was the severest possible one. The hose connection was broken between the tender and the first car and steam at full supply pressure was allowed to freely flow out from the tender hose.

"During all of the above changes in the demand on the locomotive steam supply, absolutely no readable variation could be noted on the train supply gage on the locomotive, from the 30 lbs. at which the regulator was set. The only noticeable movement in the gage hand was when the rear hose on the train, and the rear hose on the tender were opened full for steam to blow out. In these instances a slight unmeasurable vibration of the gage hand was produced, showing the rapid alternate slight opening and closing of the controlling valve in the regulator. As a final trial the regulator was set to furnish a pressure of 40 lbs., and the hose at the rear of the tender was left wide open. With this severe trial the supply pressure at the train supply side of the regulator was maintained absolutely steady. During the tests the locomotive boiler pressure varied between 200 and 205 lbs., but this variation produced no effect on the train supply pressure furnished."

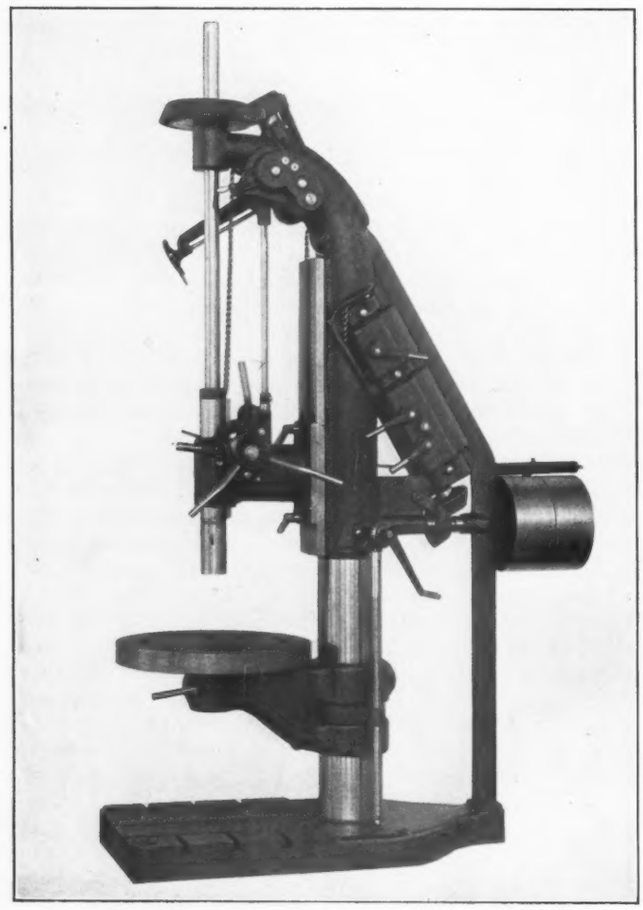
This regulator consists primarily of two main parts: A small controlling valve and diaphragm in the upper half of the regulator, and a large main supply valve and diaphragm in the lower half. Its operation is as follows: By screwing down handle *W* until spring *V* is sufficiently compressed to allow the required and predetermined delivery pressure to be furnished at the outlet side of regulator (left hand side), the controlling valve *S* is opened. Steam at boiler pressure comes into the inlet side of the regulator (right hand side) and passes up through the small passage to the space under the bottom of the controlling valve and through the open valve to a small annual groove above the valve, and thence through a small connecting passage (shown in dotted lines) downward to the space above the large diaphragm *Q*. The pressure exerted on this diaphragm presses it downward, opening the main supply valve *K*, thereby admitting a flow of high pressure steam from the inlet to the outlet side of the regulator, the steam at the same time passing upward into a chamber under main diaphragm *Q*, and also upward through a small passage into the chamber under the controlling diaphragm *R;* it presses against these diaphragms until it just balances the pressure exerted on their upper sides. If the draft on the steam on the low pressure side of the regulator is increased, it tends to reduce the pressure there. This reduction of pressure is at once transmitted to the under side of the controlling diaphragm *R* and the fixed compression in the spring *V* at once causes this diaphragm to depress and the controlling valve is opened, thereby allowing high pressure steam to pass through this valve to the top of the main diaphragm *Q*, producing a further opening of the main supply valve and an immediate increase of the supply of high pressure steam directly to the low pressure side of the regulator. If for any reason the supply or boiler pressure is reduced, the resultant pressure on the outlet or train supply side of the regulator would be momentarily slightly reduced and the consequent pressure in the chamber under the controlling diaphragm *R* would be lessened and the controlling valve would at once open slightly, thereby in its turn causing the main supply valve to open farther and give the added volume and pressure from the boiler supply side necessary to keep the train supply side up to the predetermined pressure.

If, from any cause, the pressure on the train supply side of the regulator is increased, as might be produced by a reduction of the number of cars to be supplied with steam, the increased resultant pressure on the under side of the main diaphragm *Q* would at once cause the main valve to close and at the same time this increased pressure under the controlling diaphragm *R* would hold the controlling valve tightly closed until such time as the pressure on the train supply side of the regulator was reduced to a point below the predetermined train supply pressure. The controlling valve will always be closed when the train supply pressure reaches the predetermined amount, and will at once be opened automatically when it reduces below this amount. In case of any small leakage of steam through the controlling valve to the space above the large diaphragm, such leakage will pass through the small leakage plug opening at *Z* into the train supply side of the regulator, thereby causing no opening movement of the main supply valve.

ALL-GEARED SLIDING HEAD DRILL

A 26-in. drilling machine, guaranteed to drive a 2 in. high-speed twist drill at .041 in. feed per revolution of the spindle, or at the rate of 6½ in. per minute in cast iron, is shown in the accompanying illustration. A 1 in. high-speed twist drill can be driven at the rate of 13½ in. per minute in cast iron, and it is claimed by the makers, The Barnes Drill Company, Rockford, Ill., that it has the power of the ordinary 36-in. cone belt driven drill. It is, with the exception of the sliding head, designed along the same general lines as the all-geared drills formerly built by this company.

There are eight geared speeds provided, and a similar number of geared feeds, all of which are controlled from the front of the machine. The feed for any position of the controlling levers is shown in plain figures on a plate, the ranges being from .005



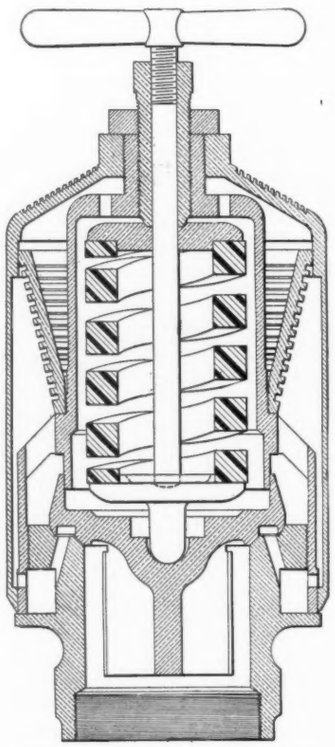
Barnes 26 in. Sliding Head, All-Geared Drill.

in. to .086 in. per revolution of the spindle. The spindle is 1 15/16 in. in diameter in the sleeve, and is double splined. The crown and pinion gears are of large diameter and have teeth of four pitch. Both the head and the sleeve are counterbalanced by weights hung in the column, the chains passing over roller bearing sheave wheels. Two quick acting clamp screws are provided for securing the head to the column face; it is raised and lowered by a crank pinion on the back of the machine, as shown in the illustration. A similar crank pinion with a threaded shaft is provided for raising and lowering the table. This machine is also suitable for some boring bar work and the feeds were selected with this in mind. Boring 8-in. holes is well within its capacity. Some of the general dimensions are as follows:

Distance from column to center of table	13¼ in.
Diameter of column	7½ in.
Diameter of table	23 in.
Vertical travel of table	20 in.
Vertical travel of sliding head	23 in.
Greatest distance from spindle to base	54 in.
Greatest distance from spindle to table	40 in.
Ratio of back gearing	4 to 1
Floor space required	22 in. x 49 in.
Weight, net	1,750 lbs.

NEW MUFFLED POP VALVE

A locomotive pop valve, which has repeatedly shown its ability to open and close on a 2-lb. blow back, has recently been designed by the American Steam Gauge & Valve Manufacturing Company, Boston, Mass. It is claimed that by the method employed all chattering and fluttering of the valve has been eliminated and that the cushioning effect is practically perfect. Reference to the illustration will show the arrangement of the parts and the scheme of operation. It will be noticed that all adjustments are made from the extreme top of the valve, the blow back ring being part of the outer casing and adjustment for this purpose being accomplished through a hexagon nut by which the



New Muffled Pop Safety Valve.

whole outer part is revolved and the outlet from the blow back chamber is enlarged or decreased as necessary. At the same place is a screw for setting the valve; but one nut lock is required for securing both adjustments. The very small number of parts required in this valve is a strong point in its favor.

The hydrostatic test plug is shown in place and permits of quickly and conveniently sealing the safety valves when it is desired to put the hydrostatic test on the boiler. This plug, of course, is removed when the locomotive is in service.

Chinese Wages.—The wages of the laborers of the Han-Yeh-Ping Iron & Coal Company, China, at the iron and coal mines are as follows: Miners, $0.13 to $0.15 per day; tipple coolies, $0.05 to $0.06 per day; loaders and pushers, $0.05 to $0.07 per day. The wages of laborers at the steel works are as follows: Rollers on mills, $0.17 to $0.35 per day; heaters on furnace and open hearth smelters, $0.27 per day; helpers, $0.17 to $0.25 per day; blacksmiths, $0.35 to $0.50 per day.

General News Section

The Missouri, Kansas & Texas is organizing safety committees in accordance with the plan which has been adopted by a number of railways recently.

The Chicago Great Western has issued the first number of a quarterly magazine devoted to the interests of employees and patrons, which is called *The Maize.*

The chairman of the house committee on interstate and foreign commerce has introduced in Congress a bill requiring the Interstate Commerce Commission to make physical valuation of all the railways in the country.

Judgments amounting to $1,575 have been entered in the federal court against the Denver & Rio Grande for violations of the hours of service law, and judgments for violations of the safety appliance law against the Pere Marquette for $1,500, and the Minneapolis & St. Louis for $200.

The canal lock which opens the connection between Lake Erie and the new Erie barge canal has been completed at a cost of $1,250,000. It is located at Black Rock harbor, Buffalo, N. Y., and is the largest inland water lock in the world. The gates are of steel and will be operated by electricity.

The proposed meeting of representatives of the mechanical department crafts of the western railways for the purpose of organizing a federation, including employees of all the roads, which was to have been held at Kansas City on March 4, has been postponed, and it is now reported that the meeting will be held on April 15.

The report of the New York state commissioner of labor for the third quarter of 1911, gives the number of union laborers out of work in the state as 12,725, which is said to be less than at the corresponding time in any year since 1907. This number is 2.7 per cent. of the membership of the unions from which the reports were received.

The Supreme Court of the United States has decided that an employee in the car repair department of a railway is a fellow servant of employees in the operating department. This decision was in a suit against the Grand Trunk Junction Railway. The opinion is by Justice Holmes, who observes that if the fellow servant doctrine is unjust, Congress is the body to change it.

Verdicts against the Canadian Pacific for damages done in Maine in the year 1898 by forest fires set by sparks from locomotives, and which have just been made public, will aggregate $139,400. The damages awarded are about 50 per cent. of the amounts claimed, and about twice as much as the railway asserted the damage to be. These were test cases representing perhaps half of the losses from the fires in question.

The number of fires on the property of the Pennsylvania Railroad system during 1911, as reported by an officer of the company, was 891, from which the loss was $304,975. The measures taken by the company to prevent fires and to reduce the loss therefrom have been very successful, and there has been a steady increase year by year in the number of fires extinguished by employees. During the past year 43 fires were put out by the apparatus carried on yard locomotives.

The Michigan railway commission has prohibited the railways of the State from exceeding certain prescribed rates of speed during the winter at several points which the commission considers dangerous. The order also prohibits making up lost time. It is said to have been suggested by a report to the commission that on one night last week 250 broken rails were found in the tracks of the Michigan Central between Detroit and Chicago and 174 on the Pere Marquette between Detroit and Grand Rapids.

The constitutionality of an act passed by the Indiana legislature in 1909 authorizing the railway commission to investigate and regulate the condition and efficiency of locomotive headlights was upheld by Judge Carter of the Superior Court on March 2, in a decision on a demurrer of the state to a suit brought by the Vandalia to enjoin the commission from enforcing an order requiring the railways to equip their locomotives with headlights of at least 1,500 candle power. The court held that the commission has the authority to make such an order.

The *Santa Fe Employees' Magazine* publishes the record of an Atchison, Topeka & Santa Fe locomotive, No. 1443, that covered 269,899 miles, still carrying its original boiler tubes, between June 13, 1907, when it was received from the Baldwin Locomotive Works, and December 8, 1911, when it was received at the Topeka shops for heavy repairs, with a total outlay for repairs of less than $2,000. The locomotive is an Atlantic type balanced compound passenger engine, and has been in service on the Middle, Southern Kansas and Oklahoma divisions.

The Joint Car Exchange Bureau at Denver on March 1 was amplified into a Joint Car Inspection and Interchange Bureau to handle the mechanical as well as the transportation inspection of cars interchanged at that point. William Hansen, who has been a traveling mechanical inspector for the Chicago, Burlington & Quincy, has been appointed manager of the bureau. The executive committee consists of J. A. Turtle, mechanical assistant superintendent of the Union Pacific; H. V. Vanbuskirk, superintendent of motive power of the Colorado & Southern, and W. A. Knerr, local freight agent of the Denver & Rio Grande.

The Illinois Central will establish 15 experimental farms along its lines in Mississippi and Louisiana to encourage agricultural development by inculcating the principles of correct farming. Each farm will consist of a 40-acre tract, to be worked by the owner under the supervision of instructors from the Agricultural College of Mississippi and the agricultural department of the University of Louisiana. Each of the tracts is to be centrally located so that the farmers of the district may reach it easily. The railway proposes to enter into contracts with the owners of the land guaranteeing them against loss.

The Permanent Manufacturers' Exhibit of Railway Supplies and Equipment was opened in the Karpen building, Chicago, March 16. As the name implies, this is to be a permanent exhibition for the purpose of bringing together devices, materials and specialties of interest to a visiting railway man so that he may conveniently and at a minimum amount of time inspect and compare the various devices in which he is especially interested. Chicago was chosen for the exhibit, because of its being the railway center of the country. The exhibition hall contains 26,000 sq. ft. of floor space, which is divided into booths of various sizes to meet the requirements of the exhibitors. Light and power is furnished for the manipulation of any working models.

General Manager J. B. Yohe, of the Pittsburgh and Lake Erie, in announcing a propaganda of safety for the employees of the road, has named the following as members of the general safety committee: L. H. Turner, superintendent of motive power, chairman; J. W. Riley, superintendent, vice-chairman; A. D. Brown, chief clerk to the general manager, secretary; J. A. Atwood, chief engineer; E. K. Connelly, purchasing agent; G. E. Shaw, general attorney, and Arthur Morgan, claim agent. Subcommittees are to be named, composed of men of the several departments. Their duties will be to minutely inquire into all accidents or losses of any kind, with a view of ascertaining the cause to prevent repetition. Economy in operation will also be looked after by the committeemen.

The Texas railway commission has received a most extraordinary petition signed by S. W. Steele, chairman of a general committee of blacksmiths, boilermakers, machinists, coppersmiths and carmen, protesting against an application of the Houston & Texas Central, which the committee believes is to be presented, for permission to issue bonds for the purpose of purchasing 50 or more locomotives. The craftsmen's petition makes no reference to the strike of mechanical department employees on the Harriman lines, but states that there are at present in Texas many idle mechanics seeking and needing employment, and that it would be more economical for the company to properly repair its present engines than to purchase new. The petition also states that the company is now employing unskilled non-residents instead of skilled mechanics, as formerly, and a much larger number than would be necessary if skilled mechanics were employed; and that the employment of non-resident labor entails on the company a greater expense than would be required to pay the skilled home labor for the same service.

The Bureau of Railway Economics, Washington, D. C., reports that there were substantial increases in the wages of railway employees during the fiscal year 1911. Reports filed with the Interstate Commerce Commission show that the total compensation to the employees of railways over 500 miles long was $1,005,277,249. This sum was greater by $41,868,822 than it would have been at the rates of pay in effect during 1910, and greater by $69,297,678 than it would have been at the rates of pay in effect during 1909. Notwithstanding an increase of 2,108 in the miles of railway operated, there were fewer employees on the payrolls June 30, 1911, than on June 30, 1910, by 31,037, yet the total compensation paid to employees during 1911 was greater than that paid during 1910 by $49,976,216. This is greater than the increase in the gross earnings of the railways by $22,595,121. Net revenues fell off by $40,988,539 during the same period in which compensation increased nearly fifty millions. The summary of revenues and expenses of the steam railways over fifty miles in length for the month of December, just issued by this bureau, shows that for the calendar year 1911 the total operating revenues were less than for the calendar year 1910 by $27,698,780, and the net revenues less by $22,286,784.

D. C. Buell, chief of the educational bureau of the Illinois Central, has issued a circular to employees announcing that the bureau is now in a position to assist employees in legal matters to a certain extent. It will endeavor to issue from time to time pamphlets for general distribution or to publish articles in the company's employees' magazine dealing with matters wherein experience has shown that for want of legal aid employees have been imposed upon so that they have suffered either financial loss or worry or unpleasantness, which could have been avoided had they known their legal rights. The circular states that it is the desire of the management to safeguard employees as much as possible and to make each employee feel that the company has a personal interest in his welfare and progress. The bureau has already afforded a means whereby employees may better inform themselves about their work, and is now taking steps to assist in the prevention of accidents by means of explanatory lessons and later by means of moving pictures to illustrate right and wrong methods. The circular continues: "The first step that the bureau will take will be to explain the methods of loan sharks. While the rules of the company as regard garnisheeing, etc., stand as they have heretofore, nevertheless any employee of the company may feel free to write to the chief of the educational bureau regarding any complications that he may have gotten into, due to obtaining a salary loan from one of these moneylenders. The object of doing this is purely a friendly one, and the cases will, as far as possible, be handled in confidence. This offer of the educational bureau carries behind it the backing of all of the organization and talent of the company's law department."

RELIEF FUND OF THE PENNSYLVANIA

Nearly two and a half million dollars in benefits were distributed during the year 1911 to members of the Relief Funds of the Pennsylvania Railroad System, according to a report issued by the company. This brings the total distribution since the establishment of the funds some twenty-six years ago, up to $33,008,804.89. Some idea of the extent of the work of these departments may be had from the fact that on the lines east of Pittsburgh and Erie during the month of December payments to the amount of $139,127.73 were made. In benefits to the families of members who died $54,898.22 were paid, while to members incapacitated for work the benefits amounted to $84,229.51.

On the Pennsylvania Lines west of Pittsburgh the Relief Fund paid out a total of $66,305.16 during the month of December, of which $28,066.71 was for the families of members who died, and $38,238.45 for members unable to work. The Long Island Railroad Company, a subsidiary of the Pennsylvania Railroad, established an Employees Mutual Relief Association in the same year that the Pennsylvania established its Employees' Relief Fund on the lines east of Pittsburgh. Since that time $857,579.33 have been distributed in benefits to Long Island employees or their families. During the year 1911, the association distributed $63,967.41 in benefits. Indicative of the popularity of the Relief Funds with the employees of the several companies is the fact that out of a total of 197,886 employees on December 31, 1911, 170,297, or 86 per cent., were members. On the Pennsylvania lines east of Pittsburgh the membership was 117,430 out of a total of 131,244 employees. The membership on the lines west was 46,343 out of 59,267, and on the Long Island, out of a total of 7,375 employees 6,524 were members.

MEETINGS AND CONVENTIONS

International Railway General Foremen's Association.—At the annual convention of the International Railway General Foremen's Association, to be held at the Hotel Sherman, Chicago, July 23-26, the following papers will be presented for discussion: How Can Shop Foremen Best Promote Efficiency? (A continuation of a paper presented at the 1910 convention) by

RAILROAD CLUB MEETINGS

Club.	Next Meeting.	Title of Paper.	Author.	Secretary.	Address.
Canadian	April 9	Swedish Steels	A. R. Roy	Jas. Powell	Room 13, Windsor Hotel, Montreal.
New England	April 9	Use of Highly Superheated Steam	G. E. Ryder	Geo. H. Frazier	10 Oliver St., Boston, Mass.
New York	April 19	The Chief Clerk	F. L. Morse	H. D. Vought	95 Liberty St., New York.
Northern				C. L. Kennedy	401 Superior St., Duluth, Minn.
Pittsburgh	April 26	Treatment and Properties of Tool Steel	W. B. Sullivan	J. B. Anderson	Union Station, Pittsburgh, Pa.
Richmond				F. O. Robinson	C. & O. Ry., Richmond, Va.
S'th'n & S. West'n	May 16	Cast Steel Tender Frames		A. J. Merrill	218 Grant Bldg., Atlanta, Ga.
St. Louis	April 12	How an Engineering Contractor Would Run a Railroad	A. P. Greensfelder	B. W. Frauenthal	Union Station, St. Louis, Mo.
Western	April 16	Boiler Failures and Water Treatment; Report of Committee on M. C. B. Rules of Interchange.	A. A. Pownall	Jos. W. Taylor	390 Old Colony Bldg., Chicago, Ill.

William G. Reyer (N. C. & St. L.); Shop Supervision and Local Conditions, by W. W. Scott (P. M.); Shop Specialization Work and Tools, by W. T. Gale (C. & N. W.); Roundhouse Efficiency, by W. Hall (C. & N. W.). Special papers will be presented on Reclaiming of Scrap, by C. H. Voges (C. C. C. & St. L.), and by C. Ogden (A. T. & S. F.); also on the Relation of Tests to Shop Efficiency, by J. S. Sheafe (I. C.), and L. A. North (I. C.).

Central Railroad Club.—Safety appliances and injury to employees was the subject of an interesting, illustrated talk given by W. O. Thompson at the March meeting. He drew attention to the fact that it is necessary in many cases to safeguard the workman against himself, and experience has shown that all possible danger points must have protection, even though it would naturally be considered that the danger was so evident as to prevent anyone overlooking it. Mr. Thompson drew quite largely for his discussion and illustrations from Mr. Bradshaw's book entitled, "Prevention of Railroad Accidents," and the photographs shown illustrated the installations of railings, guards, etc., in use on the New York Central Lines for protecting employees working near machinery in the shop and power house.

Richmond Railroad Club.—At the January meeting L. S. Randolph, professor of mechanical engineering, Virginia Polytechnic Institute, read a brief paper entitled, "The Relation of a Technical College to the Railroads." The author pointed out how methods of instruction had kept pace with the demand of the time and showed that the improvement in railway equipment, management and operation was paralleled by the improvement of the underlying ideas of instruction of a technical character. The old system of courses of instruction based on a rigid adherence to the opinions of those long dead and gone, which was intended more to train the memory than the reasoning powers, has long been abandoned by the more successful institutions and the development of courses for training the reasoning powers and adapted to specialization have been started and continued until practically trained men who are of immediate value in their chosen line are being turned out from the colleges and technical schools. The use that an engineering faculty of a modern technical institution can be to a railway management in solving some of the more elaborate problems, was mentioned and illustrated by Prof. Randolph and some of the more important questions of this character now awaiting solution were mentioned.

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting of mechanical associations.

Air Brake Association.—F. M. Nellis, 53 State St., Boston, Mass. Convention, May 7-10, Richmond, Va.

American Railway Master Mechanics' Assoc.—J. W. Taylor, Old Colony building, Chicago. Convention, June 17-19, Atlantic City, N. J.

American Railway Tool Foremen's Association.—M. H. Bray, N. Y., N. H. & H., New Haven, Conn. Convention, July 9, Chicago.

American Society for Testing Materials.—Prof. E. Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Mechanical Engineers.—Calvin W. Rice, 29 W. 39th St., New York.

Car Foremen's Association of Chicago.—Aaron Kline, 841 North 50th Court, Chicago; 2d Monday in month, Chicago.

International Railway Fuel Association.—D. B. Sebastian, La Salle St. Station, Chicago. Convention, May 22-25, Chicago.

International Railway General Foremen's Association.—L. H. Bryan, Brown Marx building, Birmingham, Ala. Convention, July 23-26, 1912.

International Railroad Master Blacksmiths' Association.—A. L. Woodworth, Lima, Ohio. Convention, August 15, Chicago.

Master Boiler Makers' Association.—Harry D. Vought, 95 Liberty St., New York. Convention, May 14-17, Pittsburgh, Pa.

Master Car Builders' Association.—J. W. Taylor, Old Colony building, Chicago. Convention, June 12-14, Atlantic City, N. J.

Master Car and Locomotive Painters' Assoc. of U. S. and Canada.—A. P. Dane, B. & M., Reading, Mass. Convention, September 10-13, Denver, Col.

Railway Storekeepers' Association.—J. P. Murphy, Box C, Collinwood, Ohio. Convention, May 20-22, Buffalo, N. Y.

Traveling Engineers' Association.—W. O. Thompson, N. Y. C. & H. R., East Buffalo, N. Y., August, 1912.

PERSONALS

GENERAL.

A. Shields, general master mechanic of the Canadian Northern at Winnipeg, Man., has resigned.

J. McAnany has been appointed district master mechanic of the Canadian Pacific at Revelstoke, British Columbia.

James Watson has been appointed district master mechanic of the Canadian Pacific at Saskatoon, Saskatchewan.

R. B. Kendig has been appointed chief mechanical engineer of the New York Central & Hudson River, with headquarters at New York.

S. J. Fero has been appointed master mechanic of the Great Northern, with office at Breckenbridge, Minn., vice C. E. McLaughlin, promoted.

T. M. Vickers has been appointed master mechanic of the Salt Lake division of the San Pedro, Los Angeles & Salt Lake, vice E. Neuhard, resigned.

B. E. Osgard has been appointed master mechanic of the Lake district of the Great Northern, with office at Superior, Wis., vice T. E. Cannon, promoted.

J. B. Kilpatrick, superintendent of motive power of the First District of the Rock Island Lines at Davenport, Iowa, has transferred his office to Des Moines.

John Pontius, road foreman of engines of the Pennsylvania Lines West at Columbus, Ohio, has been appointed general inspector of engines at Columbus.

George Langton has been appointed master mechanic of the Texas & Pacific, with office at Marshall, Tex., succeeding O. A. Clarke, transferred to Dallas, Tex.

C. S. White has been appointed road foreman of engines of the Pennsylvania Lines West, with office at Columbus, Ohio, succeeding John Pontius, promoted.

S. J. Delaney has been appointed assistant to the master mechanic of the Mohawk division of the New York Central & Hudson River, with office at West Albany, N. Y.

M. H. Strauss has been appointed master mechanic of the River division of the New York Central & Hudson River, with office at New Durham, N. J., succeeding G. H. Eck.

O. B. Hayes has been appointed assistant road foreman of engines of the Pittsburgh division of the Pittsburgh, Cincinnati, Chicago & St. Louis, with office at Steubenville, Ohio.

William C. Garaghty, air brake inspector east of the Ohio river on the Baltimore & Ohio, has been appointed general road foreman of engines, with headquarters at Newark, Ohio.

W. J. Crandall has been appointed master mechanic of the Rochester division of the New York Central & Hudson River, with office at Rochester, N. Y., succeeding W. P. Carroll, promoted.

C. E. Laughlin, master mechanic of the Great Northern at Breckenridge, Minn., has been appointed superintendent of the Dakota division, with headquarters at Grand Forks, North Dakota.

T. E. Cannon, master mechanic of the Lake district of the Great Northern at Superior, Wis., has been appointed general master mechanic of the Lake district, a new office, with headquarters at Superior.

W. R. Ladd, assistant superintendent of the Oregon division of the Oregon-Washington Railroad & Navigation Company, in charge of mechanical matters, has been appointed master mechanic of the Albina shops, with office at Portland, Oregon.

W. P. Carroll, master mechanic of the Rochester division of the New York Central & Hudson River, with office at Rochester, N. Y., has been appointed master mechanic of the Mohawk division, with office at West Albany, N. Y., succeeding S. J. Delaney.

George K. Stewart has been appointed master mechanic of the Missouri Pacific—Iron Mountain system, with office at Coffeyville, Kan. He was born August 5, 1869, at Ottawa, Kan., and received a common school education. In 1889 he began railway work as a machinist apprentice on the Atchison, Topeka & Santa Fe at Topeka, Kan., and in 1898 he went with the Missouri Pacific as a machinist, and has been with that company ever since. He was night engine house foreman at Coffeyville for two years, and was day engine house foreman for one year at the same place. He was transferred to Wichita, Kan., as division foreman in 1909, and held that position until March 4, 1912, when he was promoted to master mechanic of the Missouri Pacific—Iron Mountain system.

George K. Stewart.

A. R. Ayers, mechanical engineer of the Lake Shore & Michigan Southern, the Indiana Harbor Belt and the Chicago, Indiana & Southern at Cleveland, Ohio, has been appointed general mechanical engineer of all the New York Central Lines west of Buffalo, with office at Chicago, a new position. Mr. Ayers was graduated from Cornell University in 1900 as a mechanical engineer, and began railway work with the Lake Shore & Michigan Southern as a special apprentice in the same year, and he has been connected with the Lake Shore ever since. He was special inspector from 1903 to 1905, and in the latter year was made night engine house foreman at Elkhart, Ind. The next year he was made assistant general foreman of the Collinwood shops, and in 1907 was promoted to superintendent of shops at Elkhart. From January 1, 1908, to November 1 of the same year he was assistant superintendent of shops at Collinwood, and on the latter date was appointed assistant master mechanic, with office at Elkhart. He was appointed mechanical engineer of the Lake Shore, the Chicago, Indiana & Southern and the Indiana Harbor Belt, with office at Cleveland, Ohio, in 1910.

A. R. Ayers.

W. H. Dressel, district foreman of the Northern division of the Oregon-Washington Railroad & Navigation Company, has been appointed assistant superintendent of the Oregon division in charge of mechanical matters, at Portland, Oregon, succeeding W. R. Ladd.

W. J. Eddy has been appointed inspector of tools and machinery of the Rock Island Lines, with office at Chicago. Mr. Eddy was born in England, and previous to September, 1903, he was a machinist's apprentice and journeyman in the shops of the Choctaw, Oklahoma & Gulf at Shawnee, Okla. He was graduated from Purdue University with the degree of mechanical engineer in 1907, and in September of that year entered the service of the Erie Railroad as tool room inspector. While he was in that position the small tools were standardized and a classification and record of all shop equipment was made, as described in the Shop Section of the *Railway Age Gazette*, November 4, 1910, page 85. Mr. Eddy is also the originator of the shop standard practice system on that road, which was described in the January, 1912, issue of the *American Engineer*, page 15.

John T. Luscombe, whose appointment as master mechanic of the Cleveland, Cincinnati, Chicago & St. Louis, with office at Bellefontaine, Ohio, was announced in the March issue of the *American Engineer*, was born June 29, 1874, at Queenstown, Cork county, Ireland. He received a high school education at Belleville, Ont., and in 1891 he began railway work with the Grand Trunk at the same place. From 1891 to 1901 he served a number of roads as machinist. During this period he took a correspondence school course, and in May, 1901, he was made general foreman of the Baltimore & Ohio at Uhrichsville, Ohio, and was later transferred to Newark, Ohio, as machine shop foreman. In 1905 he went with the Chicago & Alton as machine shop foreman at Bloomington, Ill., and in September, 1907, became general foreman of the Toledo & Ohio Central at Bucyrus, Ohio. In March, 1908, he was promoted to master mechanic, which office he resigned to accept his present appointment. Mr. Luscombe's jurisdiction extends over the consolidated motive power department of the Cleveland-Indianapolis and Cincinnati-Sandusky divisions of the Big Four and the Cincinnati Northern Railroad.

John T. Luscombe.

F. J. Zerbee, formerly master mechanic at Bellefontaine, Ohio, has been appointed superintendent in charge of federal and state inspection and safety appliances on locomotives and cars of the Cleveland-Indianapolis and the Cincinnati-Sandusky divisions of the Cleveland, Cincinnati, Chicago & St. Louis, and of the Cincinnati Northern, with headquarters at Indianapolis, Ind.

P. P. Mirtz has been appointed mechanical engineer of the Lake Shore & Michigan Southern, the Chicago, Indiana & Southern, the Indiana Harbor Belt, the Lake Erie, Alliance & Wheeling, the Lake Erie & Western, the Dunkirk, Allegheny Valley & Pittsburgh, the Fort Wayne, Cincinnati & Louisville and the Northern Ohio, with office at Cleveland, Ohio, succeeding A. R. Ayers, promoted. Mr. Mirtz was born November 20, 1883, at Scranton, Pa., and was educated in the public schools at Scranton. He began railway work in 1901 with the Central Railroad of New Jersey as a mechanical draftsman, hav-

ing been for two years previous a draftsman apprentice with the American Locomotive Company. He became a mechanical draftsman for the New York, Chicago & St. Louis at Cleveland in 1903, and two years later went to the Erie at Meadville, Pa., where he had the same title. In 1906 he was appointed mechanical draftsman of the Lake Shore & Michigan Southern, was promoted to assistant chief draftsman at the Collinwood locomotive shops in 1907, and two years later was made chief draftsman at the Elkhart locomotive shops of the same company. In 1910 he was made assistant engineer of motive power at Cleveland, and he has recently been made mechanical engineer of the same road, as above noted.

F. W. Kuhlke has been appointed road foreman of engines of the Charleston & Western Carolina.

J. J. McNeil has been appointed supervisor of locomotive operation on the Mahoning division of the Erie.

W. J. Fee has been appointed road foreman of engines of the Grand Trunk, with headquarters at Lindsay, Ont.

E. Robertson has been appointed road foreman of equipment of the Chicago, Rock Island & Pacific, vice C. W. Sheffer, resigned.

John E. Sentman has been appointed acting road foreman of engines of the Philadelphia division of the Baltimore & Ohio, vice H. S. Peddicord, transferred.

Charles Snyder has been appointed traveling engineer of the Elgin, Joliet & Eastern, with special duties pertaining to fuel economy and the operation of locomotives.

CAR DEPARTMENT.

L. E. Cundiff, car inspector of the Denver & Rio Grande at Cuchara Junction, Colo., has resigned.

W. H. Pelley has been appointed coach shop foreman of the Trinity and Brazos Valley, with office at Teague, Texas.

SHOP.

W. S. Lamars has been appointed bonus inspector of the Atchison, Topeka & Santa Fe at Newton, Kan.

J. H. Davis, blacksmith foreman of the Atchison, Topeka & Santa Fe at Albuquerque, N. M., has resigned.

J. H. Jackson has been appointed locomotive foreman of the Canadian Pacific at Rogers Pass, British Columbia.

William Mason has been appointed back shop foreman of the Atchison, Topeka & Santa Fe at Arkansas City, Ark.

W. J. Coleman has been appointed locomotive foreman of the Canadian Pacific at Calgary (West), Alberta, Canada.

John T. Cosgrove has been appointed general engine house foreman of the Baltimore & Ohio at Benwood, W. Va.

J. A. Coxedge has been appointed assistant boiler shop foreman of the Atchison, Topeka & Santa Fe at Albuquerque, N. M.

P. S. Hoffer, engine house foreman of the Atchison, Topeka & Santa Fe at Shopton, Iowa, has been transferred to Shawnee, Oak.

W. J. Yingling has been appointed foreman of the Norfolk & Western, with office at Crewe, Va., vice A. S. Willard, transferred.

A. H. Asher has been appointed night engine house foreman of the Denver & Rio Grande at Lelida, Colo., vice G. M. Cykler, resigned.

H. Kaufman has been appointed foreman of the Atchison, Topeka & Santa Fe at San Bernardino, Cal., vice C. H. Angle, resigned.

W. McPherson has been appointed locomotive foreman of the Canadian Pacific at Moose Jaw, Sask., Can., vice W. Jordan, resigned.

J. T. Leudrum, shop inspector of the Atchison, Topeka & Santa Fe at Albuquerque, N. M., has been transferred to Dodge City, Kan.

W. M. Roloson, general foreman of the Atchison, Topeka & Santa Fe at Shawnee, Oak., has been transferred to Fort Madison, Iowa.

F. Lozo has been appointed locomotive foreman of the Grand Trunk Pacific, at Fitzhugh, Alberta, vice F. E. Corrigan, transferred to Rivers, Man.

William H. Edgecombe has been appointed bonus supervisor of the Eastern Lines of the Atchison, Topeka & Santa Fe, vice Wm. L. Bean, resigned.

J. A. Doig has been appointed locomotive foreman of the Canadian Pacific at Red Deer, Alberta, Canada, vice F. McFarlane, assigned to other duties.

A. S. Willard has been appointed general foreman of the Norfolk & Western, with office at Williamson, W. Va., vice D. G. Cunningham, resigned.

W. H. Graves has been appointed engine house foreman of the Chicago, Rock Island & Pacific, with office at Pratt, Kan., vice L. J. Miller, transferred.

L. J. Miller has been appointed engine house foreman of the Chicago, Rock Island & Pacific, with office at Liberal, Kan., vice W. H. Graves, transferred.

J. H. Watson, formerly district foreman of the Oregon-Washington Railroad & Navigation Company at La Grande, Ore., has been transferred to Seattle, Wash.

S. La Belle has been appointed acting general foreman of the Chicago, Rock Island & Pacific, with office at Eldon, Mo., vice H. Hamilton, assigned to other duties.

Frank Leavette has been appointed shop foreman of the Oregon-Washington Railroad & Navigation Company at La Grande, Oregon, succeeding Edward Thomas, promoted.

W. E. Keating has been appointed boilermaker foreman of the Chicago, Rock Island & Pacific, with office at Argenta, Ark., vice L. E. Warren, assigned to other duties.

Edward Thomas has been appointed division foreman of the Oregon-Washington Railroad & Navigation Company, with office at La Grande, Ore., succeeding J. H. Watson.

William B. Taylor has been appointed car foreman of the Chicago, Rock Island & Pacific, with office at Liberal, Kan., vice John Fletcher, transferred to the St. Louis division.

J. Fletcher has been appointed general foreman of the Chicago, Rock Island & Pacific, with office at Carrie avenue, St. Louis, Mo., in place of E. S. Butler, assigned to other duties.

C. J. Humbert, foreman of the blacksmith shop of the Trinity & Brazos Valley at Teague, Tex., has resigned to go with the International & Great Northern at Palestine, Tex., in a similar capacity.

PURCHASING AND STOREKEEPING.

C. M. Smith, division storekeeper of the Atchison, Topeka & Santa Fe at Richmond, Cal., has resigned.

H. D. Weir has been appointed storekeeper of the Atchison, Topeka & Santa Fe at Richmond, Cal., vice C. M. Smith.

C. M. Rouse has been appointed storekeeper of the Atchison,

Topeka & Santa Fe at Gallup, N. M., vice J. A. Brackett, transferred to Winslow, Ariz.

OBITUARY

Robert Patterson, a number of years ago master mechanic of the Florence & Cripple Creek Railroad, died at his home in Denver, Colo., on March 10, at the age of 60 years.

Joshua B. Barnes, formerly superintendent of the locomotive and car department of the Wabash, with office at Springfield, Ill., died at Springfield on February 21. Mr. Barnes was born December 13, 1840, at Reservoir, Lincolnshire, Eng., and began railway work in 1856. Previous to 1861 he was master mechanic of the Dubuque, Marion & Western, now part of the Chicago, Milwaukee & St. Paul, and from 1861 to 1862 was machinist on the Pittsburgh, Fort Wayne & Chicago. In the latter year Mr. Barnes went with the Wabash, St. Louis & Pacific, and remained with that road and its successor, the Wabash, until his retirement in 1907. From 1862 to 1882 he was general foreman in the machinery department and was then for three years master mechanic; from 1885 to 1905, superintendent of motive power and machinery, and on July 1, 1905, his jurisdiction was extended over the car department, with the title of superintendent of the locomotive and car department, which title he retained until the time of his retirement several years ago.

R. F. McKenna, former president of the Master Car Builders' Association, and master car builder of the Delaware, Lackawanna & Western from March, 1904, to September, 1909, died on March 16 at Philadelphia, Pa., from the effects of a surgical operation. Mr. McKenna was born on November 14, 1868, at Scranton, Pa., and began railway work as an apprentice on the Delaware, Lackawanna & Western in 1884. In 1891 he was made chief draftsman in the car department. From 1892 to 1893 he was manager of the Buffalo Car Wheel Company. After that he returned to railway work as chief air brake instructor and foreman of the car shops of the Lackawanna at Scranton. In 1869 he was appointed general foreman of the Eastern division at Dover, N. J., where he remained until 1902, when he was appointed general foreman of the Scranton division. The following year he was made superintendent of car shops, and in March, 1904, he was appointed master car builder, from which position he resigned on September 1, 1909, because of the gradual failure of his health. Mr. McKenna's entire railway career had been with the Delaware, Lackawanna & Western. The first act of importance after his appointment as master car builder was to develop the organization and operation of the large car shops at Keyser Valley. He was president of the Central Railway Club at Buffalo in 1908. For a number of years, and until his death, he was chairman of the educational committee of the Railroad Department of the Y. M. C. A. Mr. McKenna's delightful personality, together with his high ideals and strong character, made for him a host of friends by whom he was held in the highest regard.

R. F. McKenna.

NEW SHOPS

Ann Arbor.—Plans are being perfected for new car shops, a 40-stall engine house, machine, paint and repair shops and a smelting plant, which will cost approximately $400,000 with the new trackage proposed, at Owosso, Mich.

Atchison, Topeka & Santa Fe.—It is reported that shops and an engine house will be built at Pueblo, Col.

Baltimore & Ohio.—The work on the general enlargement of the terminal facilities, at Garrett, Ind., will begin early in April. A new machine shop will be built at Mt. Claire, Md. A new engine house and turntable will be installed at Garrett, Ind., and the shops will be enlarged.

Canadian Pacific.—Contracts have been awarded for the construction of engine houses at Swift Current, Sask., and at Outlook, Regnia and Wilkie.

Chicago, Burlington & Quincy.—It is reported that a new engine house and turntable will be constructed at Broken Bow, Neb.

Denver & Rio Grande.—Announcement has been made that this company will spend about $15,000,000 within the next two years for betterments and improvements, which will include the enlargement of the Denver, Col., shops.

Duluth, South Shore & Atlantic.—A new engine house will be built at Sault Ste. Marie, Mich.

Erie.—Repair shops will be built at Randall, Ohio, during the coming summer.

Illinois Central.—It is rumored that the repair shops at McComb City, Miss., and Water Valley will be removed to Jackson.

Kansas City, Mexico & Orient.—The Sweetwater, Tex., shops will be transferred to San Angelo.

Louisville & Nashville.—New shops will be constructed at Winchester, Ky.

Lake Shore & Michigan Southern.—It is reported that this road will build repair shops and two engine houses which will have a capacity of 15 locomotives at Air Line Junction, near Toledo, Ohio.

Missouri, Kansas & Texas.—It is reported that some land has been purchased for a new engine house and shops at San Antonio, Tex.

Norfolk & Western.—The improvements to the erecting shop at Roanoke, Va., will probably be carried out during the coming summer.

Northern Pacific.—It is reported that the South Tacoma repair shops will be removed to Auburn, Wash.

Pennsylvania Railroad.—Plans are being prepared for an extension to the repair shops at Pitcairn, Pa.

Southern Pacific.—An engine house will be built at Beaumont, Tex. It is reported that work on a large car shop at Oswego, Ore., will soon be started.

Toledo & Ohio Central.—Two new buildings will be built at this company's shop at Bucyrus, Ohio, at a cost of $30,000.

Virginian Railway.—It is reported that additions will be made to the shops at Princeton, W. Va. Ten stalls will be added to the engine house; a 100-ft. addition will be made to the machine shop and a 12-stall stripping shop will be constructed.

Western Maryland.—A new machine shop will be erected at Hagerstown, Pa. A 30-stall brick engine house will be erected at Cumberland, Md., and Hagerstown.

SUPPLY TRADE NOTES

Scully-Jones & Company, Chicago, have been made exclusive agents in Illinois, Indiana, Iowa and Wisconsin for Elco high-speed steel, made by Vickers Sons & Maxim, Sheffield, Eng.

C. W. Reinhardt, for the past 20 years chief draftsman of the *Engineering News,* New York, has resigned his position and opened a general drafting office at 120 Liberty street, New York.

Frederick Maley, formerly with the Baldwin Locomotive Works, Philadelphia, Pa., has been made superintendent of the oxy-acetylene department of the Alexander Milburn Company, Baltimore, Md.

The Lansing Company, Lansing, Mich., recently purchased the entire hoist building plant of the Butcher & Gage Company, Jackson, Mich., and in the future will manufacture the Wolverine hoists in Lansing.

Philip H. Ryan has resigned his position in the mechanical department of the New York Central & Hudson River to enter the railway department of the American Steam Gauge & Valve Manufacturing Company, Boston, Mass.

Martin Prehn, assistant eastern manager and associate editor of the *Railway & Engineering Review,* Chicago, has been made sales manager of the Revolute Machine Company, New York, manufacturers of blue printing machinery.

Jesse Lantz, vice-president of the Goodwin Car Company, New York, died March 20. Mr. Lantz was actively engaged in business at the time of his death and has been connected with the Goodwin Car Company for the last 10 or 12 years.

Willis L. Riley, formerly in charge of the freight car drafting department of the Union Pacific at Omaha, Neb., has been appointed mechanical engineer and assistant superintendent of the Moore Patent Car Company, St. Paul, Minn.

The Baldwin Locomotive Works has filed a notice for the proposed incorporation of the Chicago plant under the Pennsylvania laws. William L. Austin, Alba B. Johnson, Samuel M. Vauclain and William Burnham are named as the incorporators.

C. C. Owens, in the New York sales office of the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., with special charge of the industrial and power division, has been made district manager of the Westinghouse company, with office in Detroit, Mich.

The reorganization committee of the Allis-Chalmers Company, Milwaukee, Wis., has given out its plans of reorganization. The preferred stock will be assessed 20 per cent., or $3,210,000; the common stock, 10 per cent., or $1,982,000, providing $5,192,000 working capital.

Cornell S. Hawley, former president of the Consolidated Car Heating Company, Albany, N. Y., has been made president of the Laconia Car Company, Boston, Mass. Craig Colgate, William L. Putnam, Harold J. Coolidge and Robert T. Pine, 2nd, were elected to the board of directors.

The interest of E. A. Schumacher in the firms of Schumacher & Boye and Schumacher, Boye & Emmes, manufacturers of engine lathes, has been acquired by F. W. Boye, Jr., and W. T. Emmes, who have incorporated as the Boye & Emmes Machine Tool Company. The general office is at Cincinnati, Ohio.

W. D. Smith and Elmer J. Smith, of the Peter Smith Heater Company, Detroit, Mich., have purchased the Baker Heater Company of New York and have removed its offices and shops to 88 Isabella avenue, Detroit, Mich., where the business will be operated in connection with the Peter Smith Heater Company.

The U. S. Metal & Manufacturing Company, New York, has changed the name of its one-piece steel ladder for box cars, etc., from "Interstate" to "Safety." This change was made owing to the fact that after marketing a large number of ladders the company found that the name was similar to that of a ladder made by another company.

Dr. P. H. Conradson, chief chemist of the Galena Signal-Oil Company, Franklin, Pa., will, on April 10, 11, 12 and 13, deliver a series of lectures in the assembly room of the Permanent Manufacturers' Exhibit of Railway Supplies and Equipment, Karpen building, Chicago, on "The Lubrication of Steam Engines," dealing particularly with the use of high degree superheat in locomotive practice.

The Vulcan Engineering Sales Company has been organized and incorporated, with offices in the Fisher building, Chicago, and 30 Church street, New York. The company controls the entire product and will handle all sales of the Hanna Engineering Works of Chicago, Mumford Molding Machine Company of Plainfield, N. J., and Q M S Company of New York. Further factory arrangements are under way and the Vulcan company will own and manufacture a number of railway special tools and equipment for the shop and maintenance departments. The officers are H. K. Gilbert, president, formerly vice-president of the Buda Company—and P. W. Gates, secretary and treasurer, now president of Hanna Engineering Works, and formerly president of Gates Iron Works. E. H. Mumford, now vice-president and general manager of the Mumford Molding Machine Company, will continue in the same position and duties as heretofore, and William L. Laib, vice-president and secretary of the Hanna Engineering Works, will continue in his present position with that company.

T. R. Wyles, second vice-president of the Detroit Graphite Company, Chicago, was elected a director of the company at its recent annual meeting. Mr. Wyles has been connected with the Detroit Graphite Company since 1897, when he entered its employ as agent, and has been second vice-president since 1907. He was born in Prince Edward county, Ontario, January 14, 1872, and attended an English public school from 1879 to 1888. Until the fall of 1890 he was employed in various capacities in the coal business and tobacco business at Richmond, Va., and during the next year was private secretary to the president of the Lambert Pharmacy Company at St. Louis, Mo. From 1891 to 1896 he was a stenographer in the purchasing department of the American Refrigerator Transit Company at St. Louis, and from 1896 to 1897, contracting freight agent of the company at Chicago, which position he left to become connected with the Detroit Graphite Company.

The Bucyrus Company, South Milwaukee, Wis., has taken over the manufacture of the Atlantic type shovel, heretofore built by the American Locomotive Company, New York, and under a license from A. W. Robinson, the patentee, it is the expectation of the company to continue to build all of the sizes previously built, and to eventually have a complete line of Atlantic wire-rope shovels, in addition to a complete line of Bucyrus chain-type shovels. The Bucyrus company has transferred the manufacture of Vulcan shovels from Toledo, Ohio, to the new plant at Evansville, Ind. Norman B. Livermore & Co., San Francisco, Cal., will handle the steam shovels, wrecking cranes, pile drivers and ballast plows of the Bucyrus company in California, and the same products, with the addition of drag line excavators, in Nevada, Utah and Arizona. Arrangements have been made with the Yuba Construction Company, San Francisco, Cal., for the handling of the Bucyrus dredges on the Pacific coast and in Alaska. Smith & Wiggins, Mexico City, Mex., are agents for the Bucyrus company in Mexico. George B. Massey, for a number of years in charge of the New York office of the company, is now at South Milwaukee preparing for an extensive trip abroad in the interest of the company's foreign business.

CATALOGS

Dust Guard.—The Virginia Equipment Company, Toledo, Ohio, has issued a folder describing the advantages of its journal box dust guard.

Derailers.—The Hobart-Allfree Company, Chicago, has issued catalog No. 113, describing and illustrating the Smyth and the Freeland derailers.

Fire Extinguisher.—The Pyrene Manufacturing Company, New York, has published a small illustrated folder describing and pointing out the advantages of Pyrene as a fire extinguisher.

Boiler Tools.—The J. Faessler Manufacturing Company, Moberly, Mo., has published an illustrated folder describing the Faessler, octagonal section expanders, roller expanders and flue cutting machines.

Valves & Fittings.—The Crane Company, Chicago, has published a special railway catalog, No. 42-A, illustrating and briefly describing its line of valves, air-brake fittings, unions, union fittings, etc. The prices are included.

Culverts.—The Canton Culvert Company, Canton, Ohio, has published form No. 26 on its Acme Nestable Corrugated No-Co-Ro metal culverts. It is illustrated and gives descriptions and calls attention to the advantages of these culverts.

Packing.—The Detroit Leather Specialty Company, Detroit, Mich., makers of the "Wear Well" leather packing, has issued a pamphlet entitled "Efficiency," which tells why the highest quality of leather packing should be used in air brake work.

Oxygen and Hydrogen Generators.—The International Oxygen Company, New York, has issued a 16-page pamphlet describing the I. O. C. system for producing pure oxygen and hydrogen. These gases are used in the oxy-hydrogen process of cutting and welding.

Flexible Trucks.—The McConway & Torley Company, Pittsburgh, Pa., has issued a pamphlet describing and illustrating the Buhoup flexible truck. The design of the truck is made as simple as possible, and is such that it is flexible to vertical movements, but rigid to any twisting or angular horizontal movements.

Southern Railway.—The land and industrial department of this company has published a 32-page, illustrated booklet on Kentucky, in which it describes the physical conditions, the climate, the resources and the products of this state. This booklet will be found very useful to the prospective home-seeker or investor, as it includes many definite facts on the various industries in Kentucky.

Locomotive Stokers.—Clement F. Street, Schenectady, N. Y., has issued publication No. 6 on the Street locomotive stoker, in which each function of this stoker is clearly and concisely described. Illustrations are given of each separate part, and also of the stoker applied to locomotives. Illustrations and the principal dimensions of five of the largest locomotives on which these stokers have been successfully used are given.

Valves.—The Homestead Valve Manufacturing Company, Pittsburgh, Pa., has issued a 40-page catalog and price list of the Homestead valves. Straightway valves designed for pressures of 150 lbs. per sq. in. to 3,000 lbs. per sq. in.; three-way valves up to 1,500 lbs. per sq. in. capacity, and four-way valves up to 600 lbs. per sq. in. capacity are described and illustrated, the list prices being given for the various kinds and sizes.

Tube Corrosion.—The National Tube Company, Pittsburgh, Pa., has published bulletin No. 4 containing an article entitled Corrosion of Boiler Tubes, by Rear Admiral John D. Ford, U. S. N. This is an abstract of an article from the Journal of the American Society of Naval Engineers of May, 1904. The results of a number of tests are described and illustrations are included of tubes after they have been submitted to various tests.

Texas & Pacific.—The passenger department of this company has published the first number of its quarterly for 1912. This issue contains about 100 pages, is fully illustrated and gives detailed information on the productivity and fertility of the territory along the company's lines. Separate discussions are devoted to the different sections of the country, and valuable data are given on the numerous opportunities for both industrial and agricultural enterprises.

Equipment Insulation.—The Union Fibre Company, Winona, Minn., has published a 110-page booklet telling of the evolution of the refrigerator car in the United States, tests of the heat and cold-resisting properties of refrigerator cars and some data on insulation of refrigerator cars, steel passenger cars, etc. A description is also included of a refrigerator car built by the Union company to show its ideas of insulation, air circulation, ventilation and drainage for such equipment.

Axle Car Lighting.—The United States Light & Heating Company, New York, has published three bulletins on the Bliss system of axle electric car lighting. Bulletin No. 207 is illustrated and gives detailed descriptions of this system. Bulletin No. 105 describes the National storage batteries for electric lighting of railway cars, which are used in connection with the Bliss system of axle car lighting. Bulletin No. 208 A is devoted to a list of spare parts for axle car lighting equipments.

Brake Shoes.—The Allen & Morrison Brake Shoe & Manufacturing Company, Chicago, has issued an illustrated catalog describing the advantages of the Acme steel-back, locomotive-driver brake shoe. The principal feature is the tire dressing obtained by hard metal inserts triangular in form and presenting an inclined shearing edge across the face of the shoe. A full report of tests of this shoe in various classes of service, with illustrations showing the comparative tire wear, is included in the catalog.

Steam Tables.—The Wheeler Condenser & Engineering Company, Carberet, N. J., has issued a 32-page pamphlet giving steam tables which are especially convenient for condenser work. Three tables give the properties of saturated steam from a 29.8 in. vacuum to atmospheric pressure; from 32 deg. F. to 212 deg. F., and from zero pounds (gage) to 200 lbs. (gage). Information is also presented concerning the use of the mercury barometer and the constant to be used for temperature and other corrections of the barometer.

Turbine Pumps.—The Lea Equipment Company, Wayne Junction, Philadelphia, Pa., has issued Bulletin *K*, describing its high-duty turbine pumps. The construction of this type of pump is much simpler than those of the reciprocating type, and it has been perfected so that its efficiency and reliability is established. They may be driven by motor, belt or the steam turbine, and occupy a comparatively small space per unit of capacity. A description of the design and materials used in construction is also included in the bulletin.

Nickel Steel.—In a paper on the heat treatment of nickel steel, written by W. Campbell and H. B. Allen and read before the American Society for Testing Materials, it was found that a steel with 3.15 per cent. nickel, 0.27 per cent. carbon, and 0.65 per cent. manganese, may be refined by heating to 750 degs. C., which is about 75 degs. lower than for an ordinary carbon steel. Hardening is complete when quenched from this temperature, but higher tensile strength was obtained by quenching around 900 degs. C. Overheating becomes marked above 1,200 degs. Tempering of bars quenched in water or oil gives very uniform increase in ductility and decreases in strength, the change varying very uniformly with the temperature of reheating, till at 650 degs. C. the properties are very nearly those of the original steel, having a slightly lower elastic limit and greater reduction in area.